



Figure S01. Photos of pre-1861 microatolls from southeastern Simeulue, each exhibiting a wide, low-relief interior that is surrounded by concentric “stair step” rings rising dramatically outward. (a,b) LBJ-2, amidst a population of similar microatolls; the radial slab we extracted is 2.6 m long. (c) A large tilted microatoll with a similar morphology, Pulau Batu Belahir, southeastern Simeulue. (d) LAT-1, Latiung site. (e) LAT-2, Latiung site. (f) LAT-4, Latiung site.

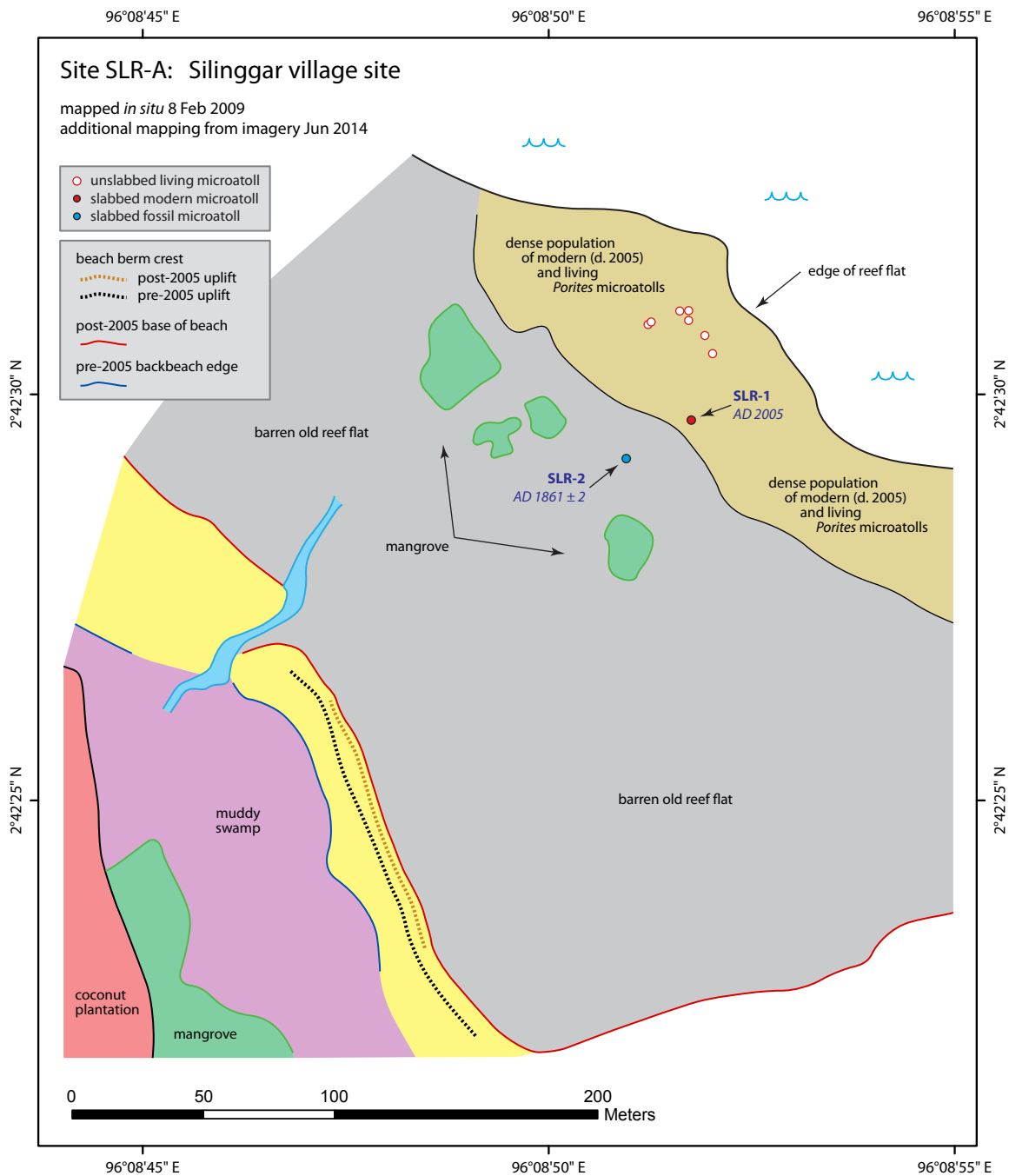


Figure S02. Map of site SLR-A, northeast coast of Simeulue, showing sampled microatolls and the date of each microatoll's outer band.

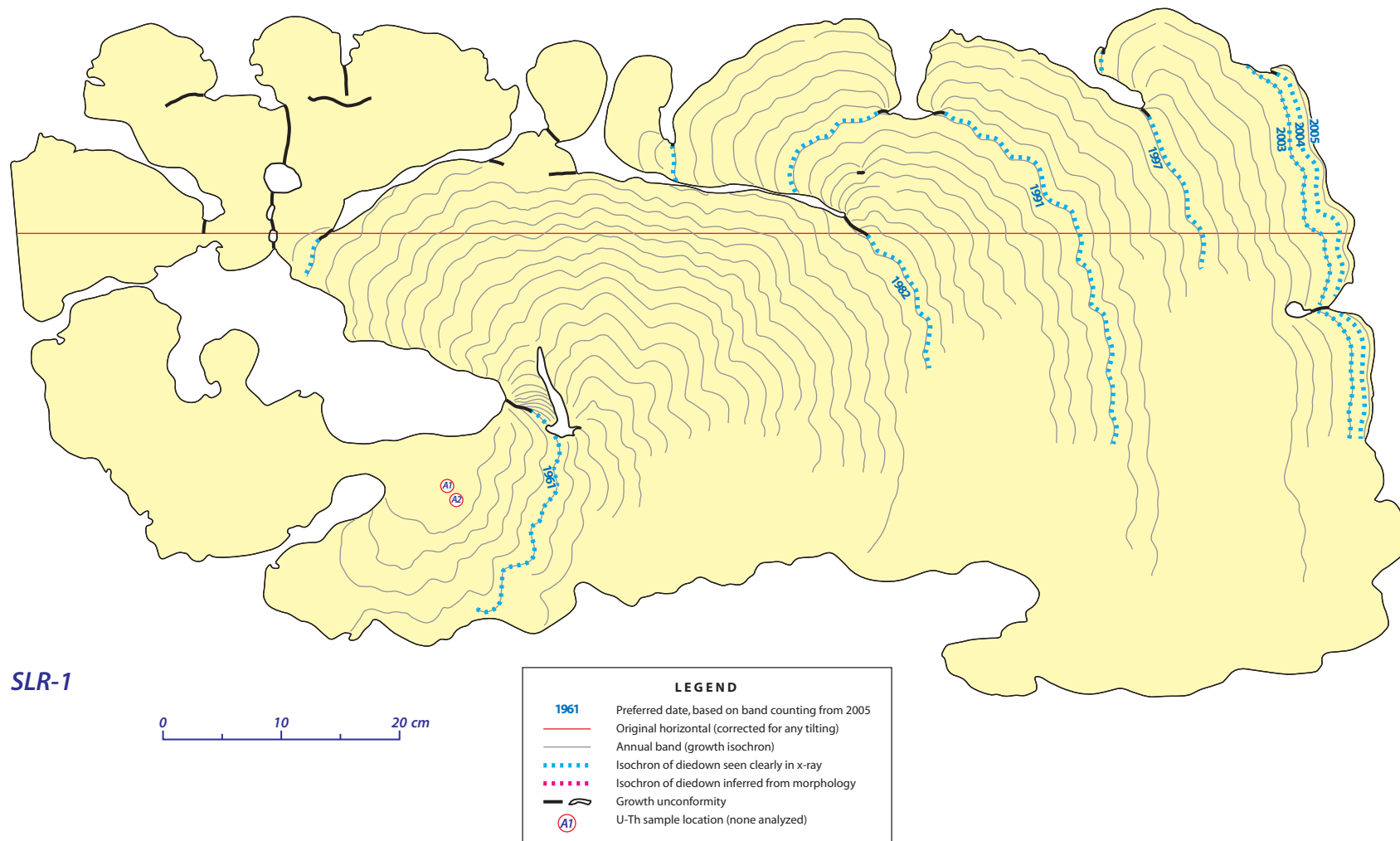


Figure S03. Cross-section of slab SLR-1, from site SLR-A.

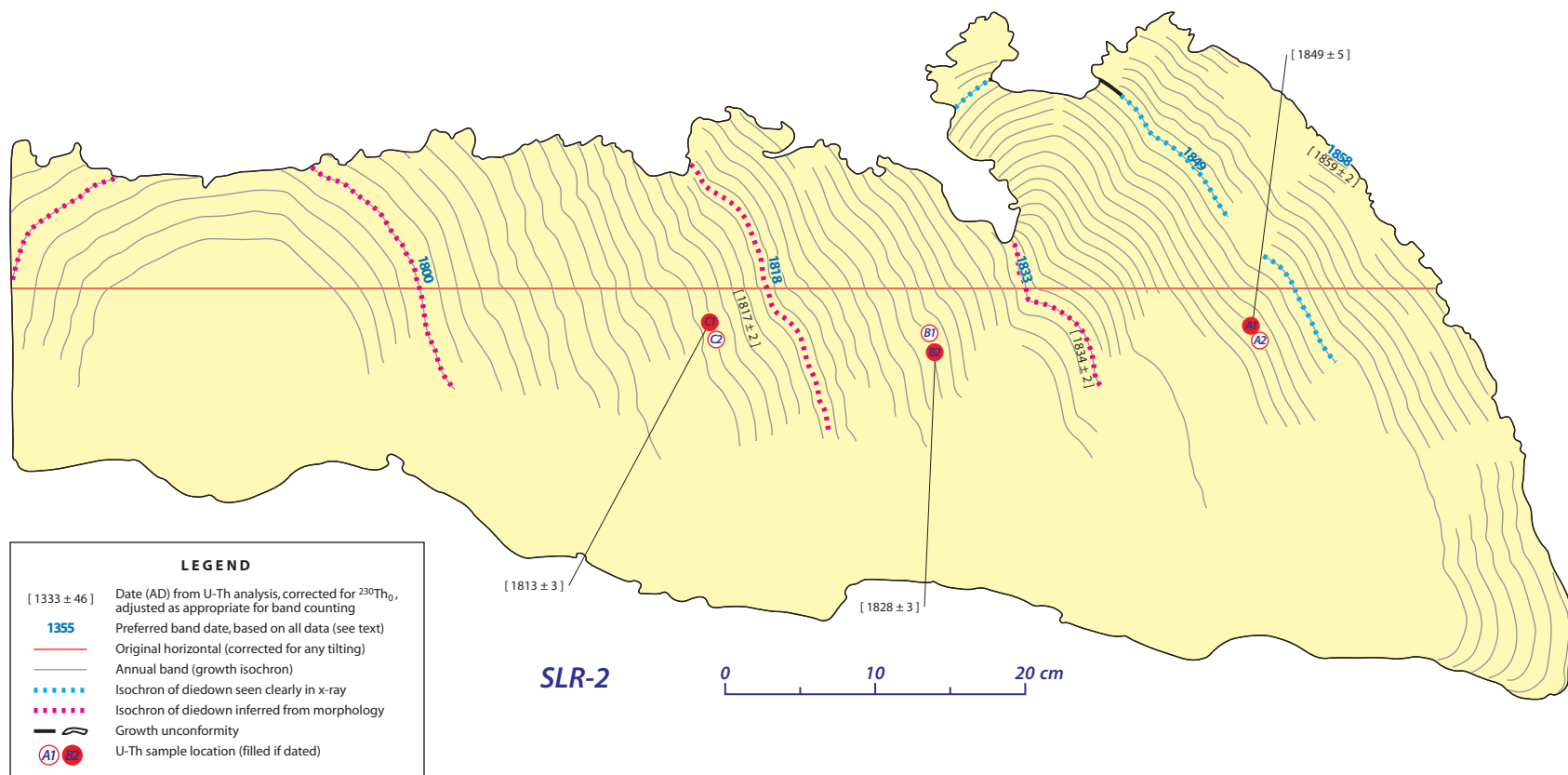


Figure S04. Cross-section of slab SLR-2, from site SLR-A.

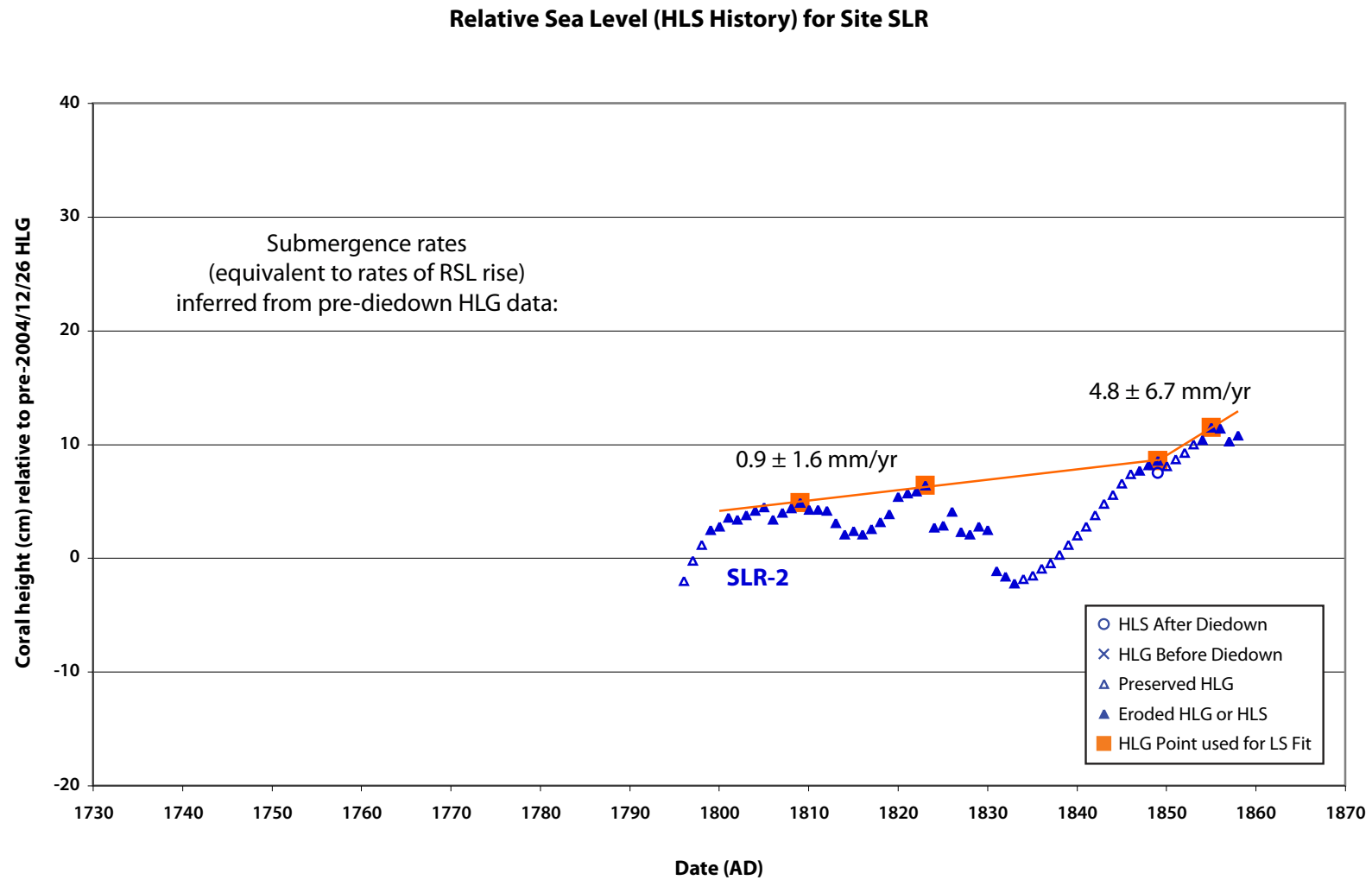


Figure S05. Relative sea level history derived from slab SLR-2.

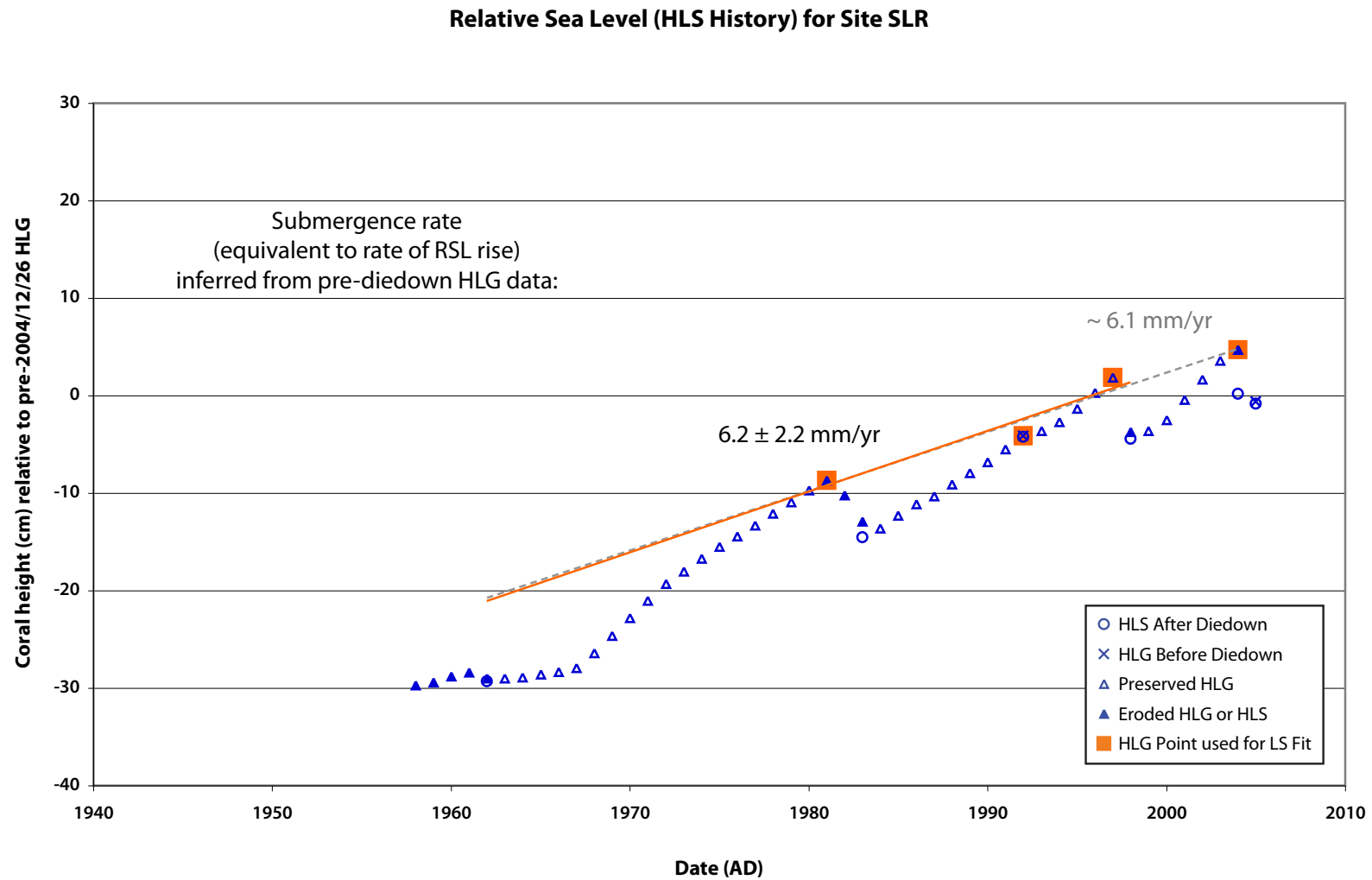


Figure S06. Relative sea level history derived from slab SLR-1.

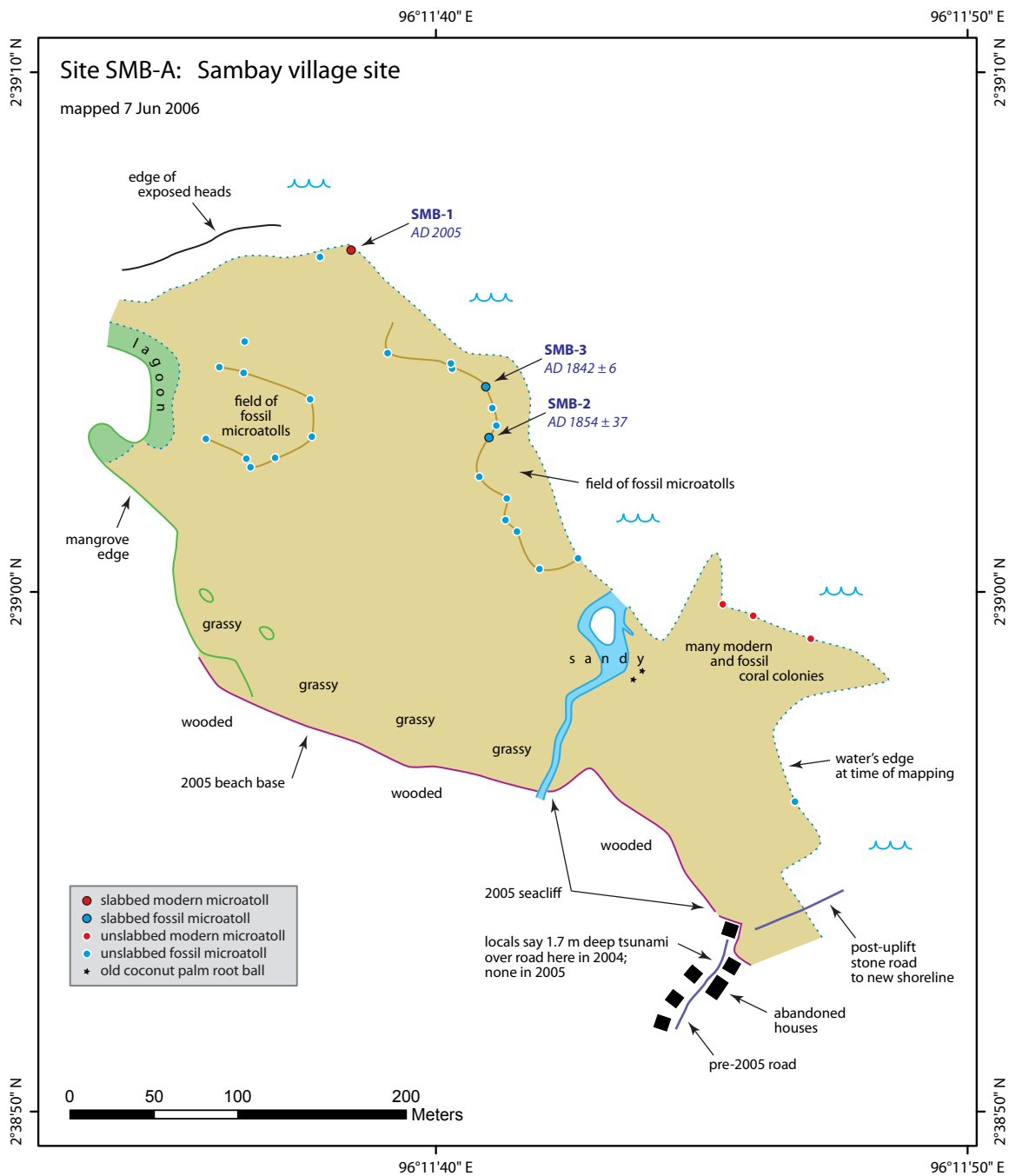


Figure S07. Map of site SMB-A, northeast coast of Simeulue, showing sampled microatolls and the date of each microatoll's outer band.

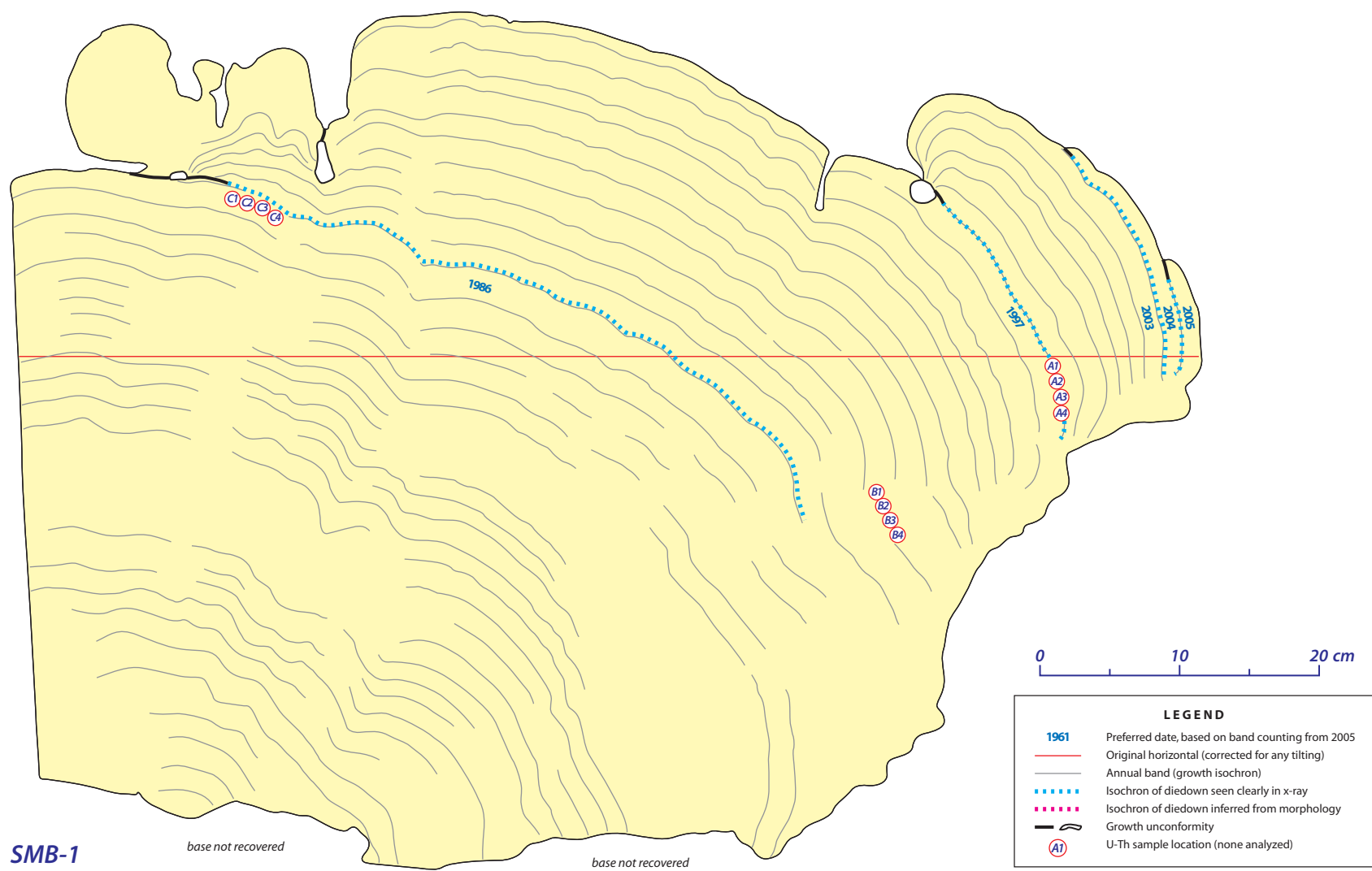


Figure S08. Cross-section of slab SMB-1, from site SMB-A.

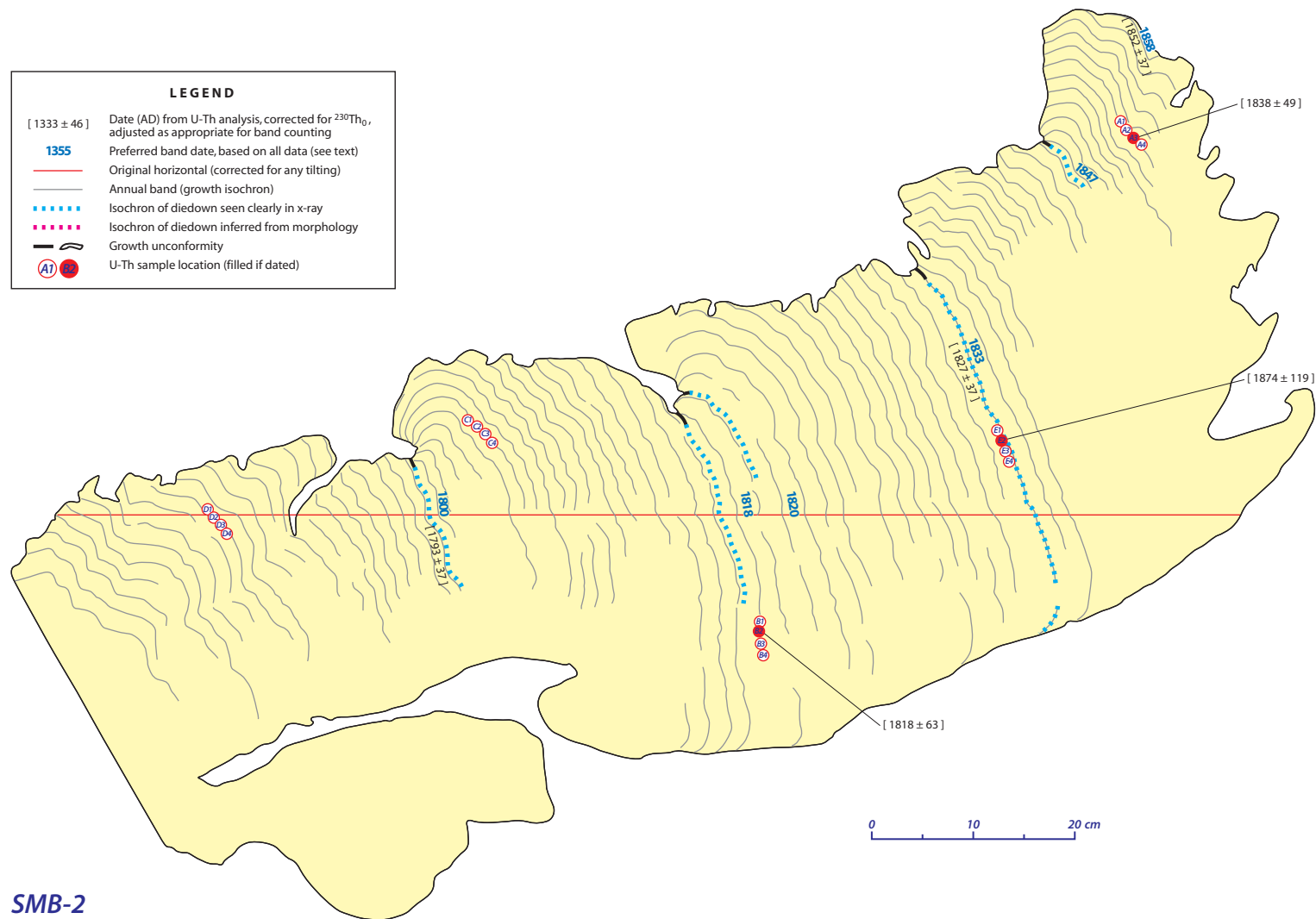


Figure S09. Cross-section of slab SMB-2, from site SMB-A.

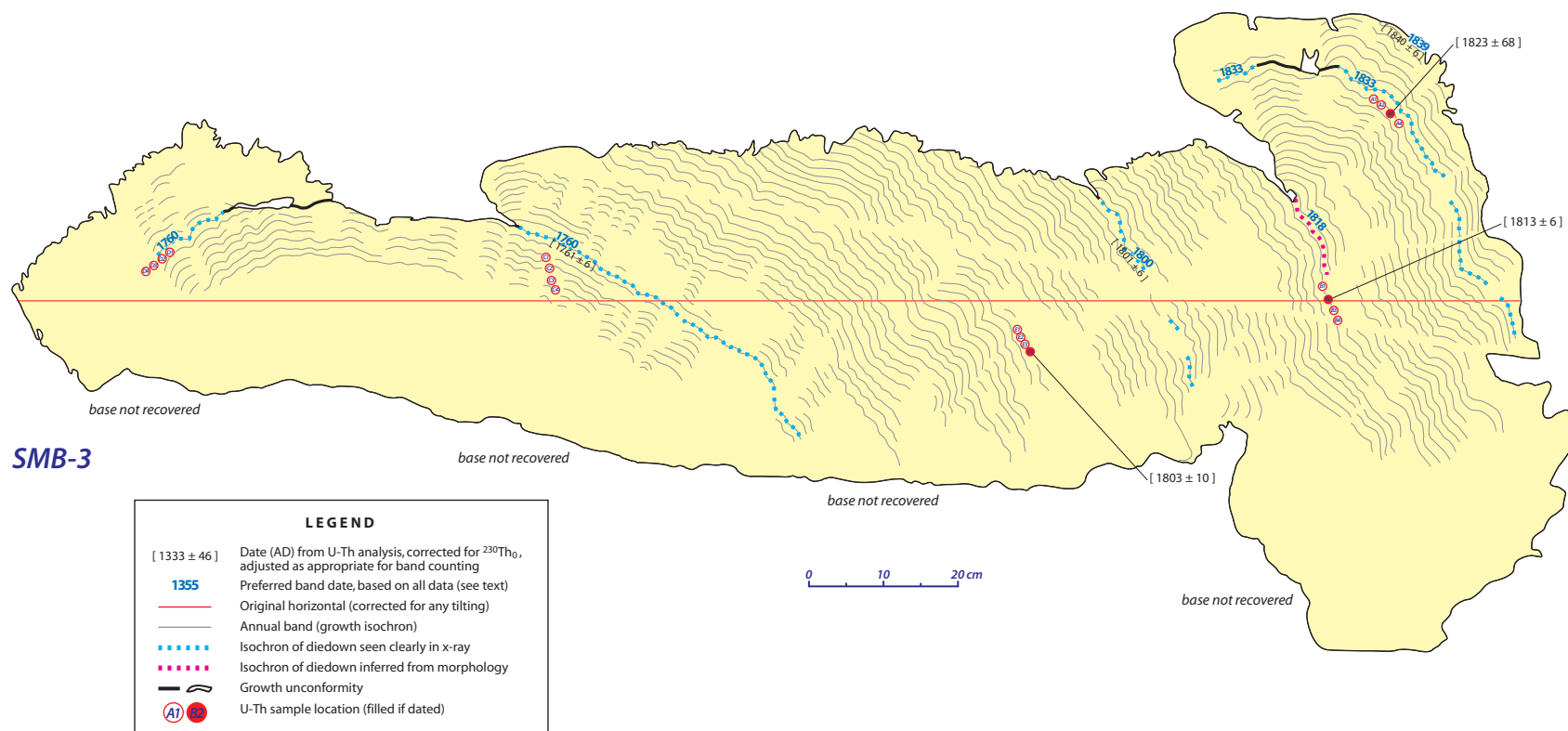


Figure S10. Cross-section of slab SMB-3, from site SMB-A.

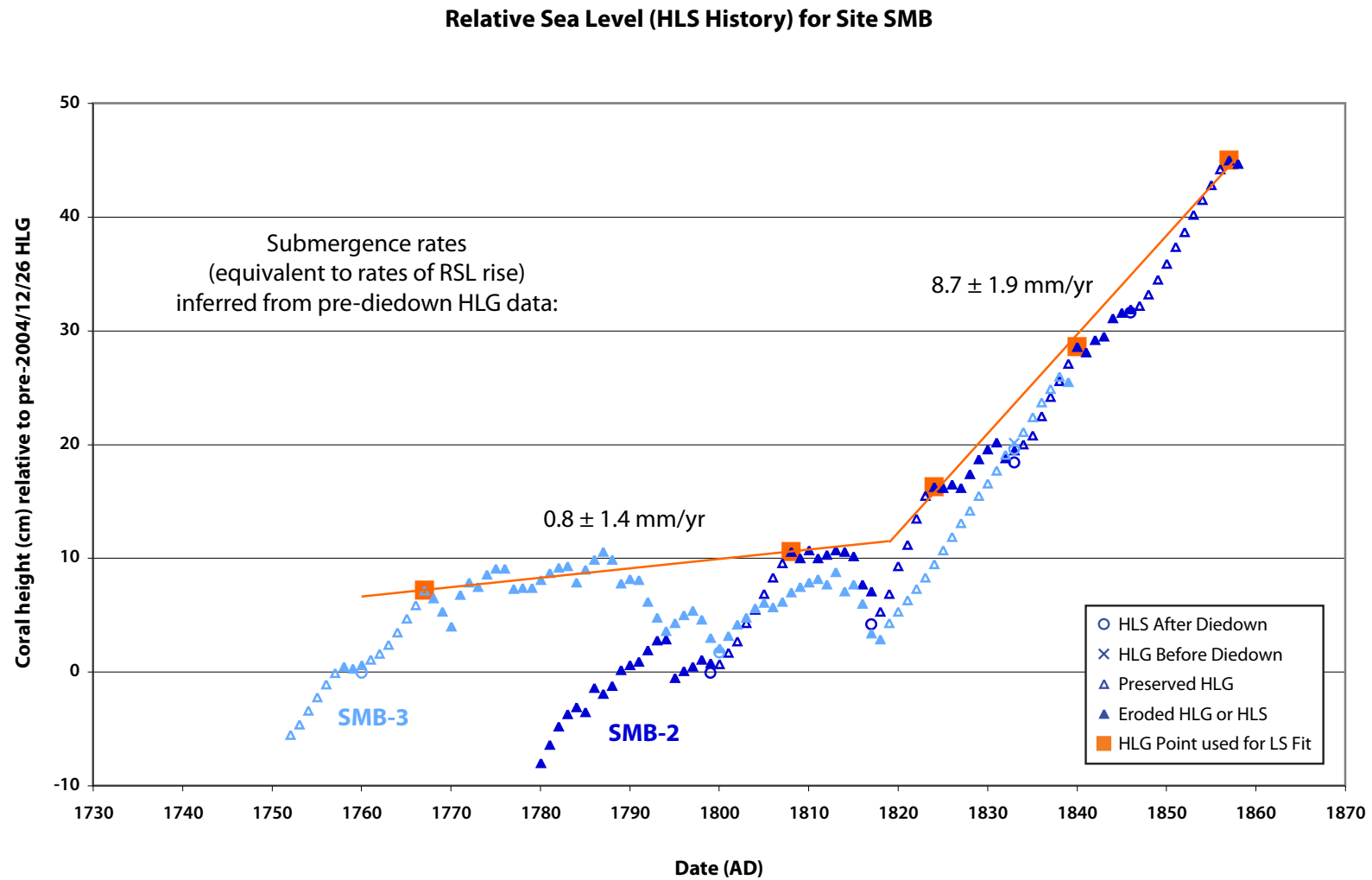


Figure S11. Relative sea level history derived from slabs SMB-2 and SMB-3. Different colors represent data from different corals at the site.

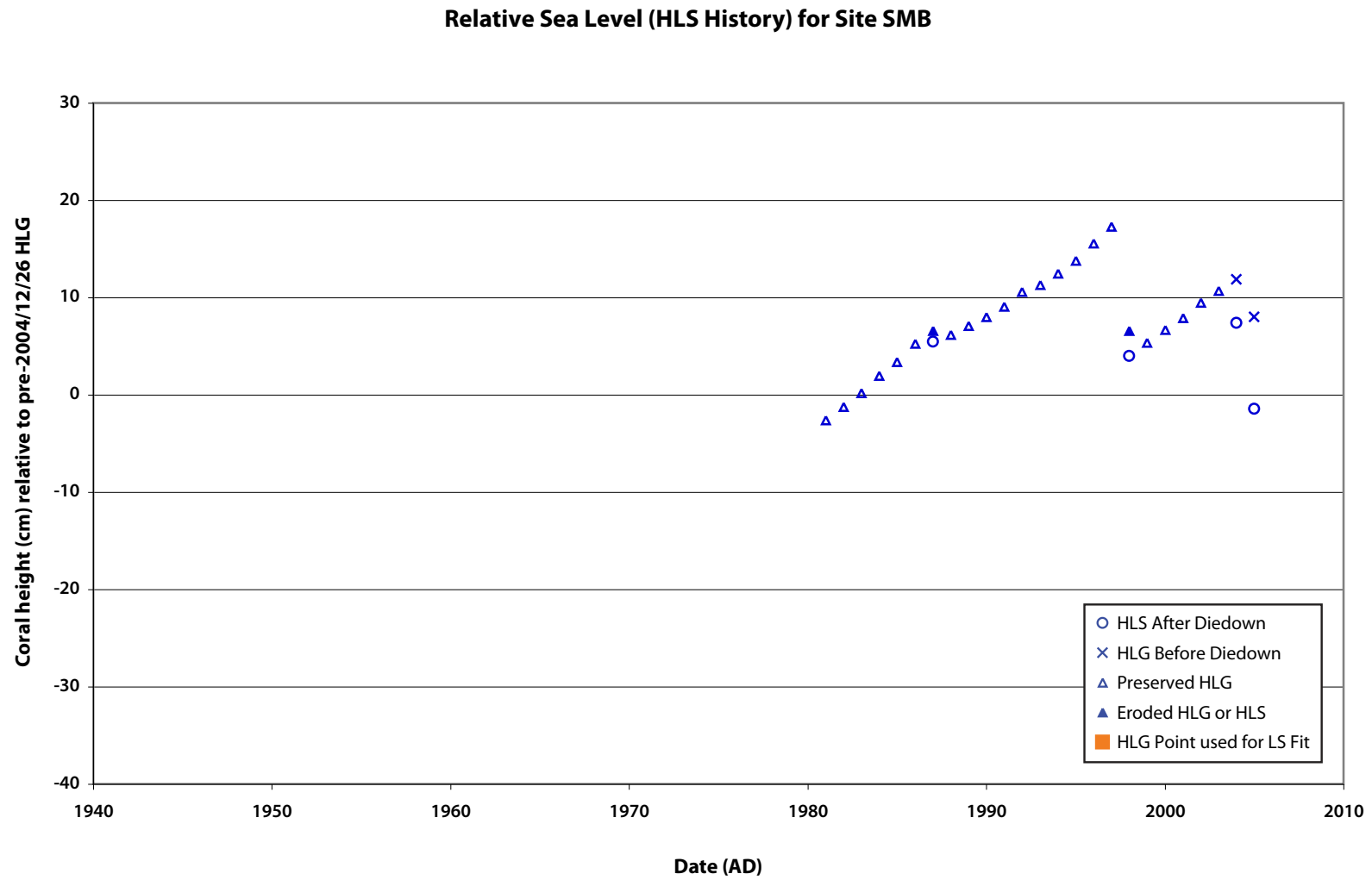


Figure S12. Relative sea level history derived from slab SMB-1.

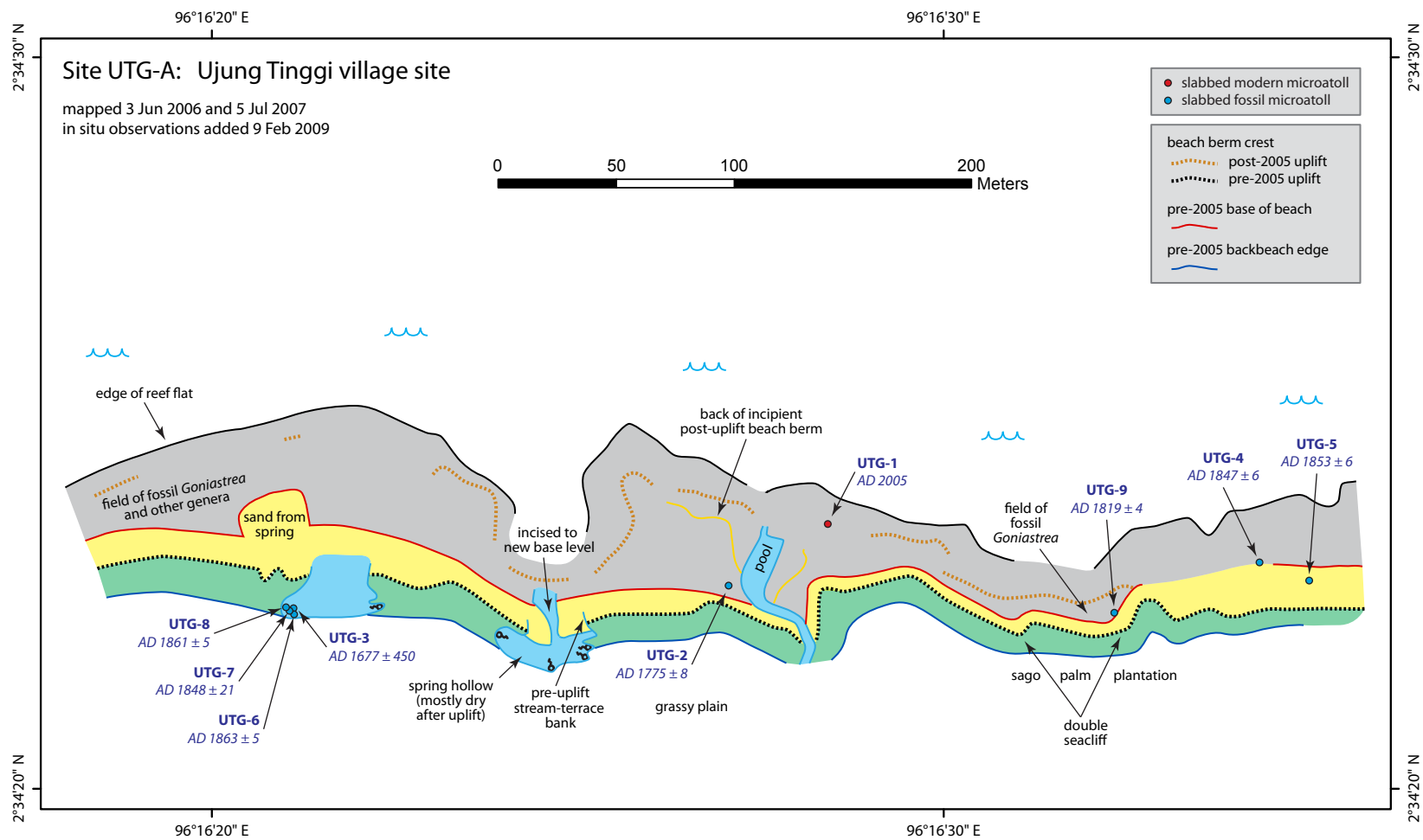


Figure S13. Map of site UTG-A, northeast coast of Simeulue, showing sampled microatolls and the date of each microatoll's outer band.

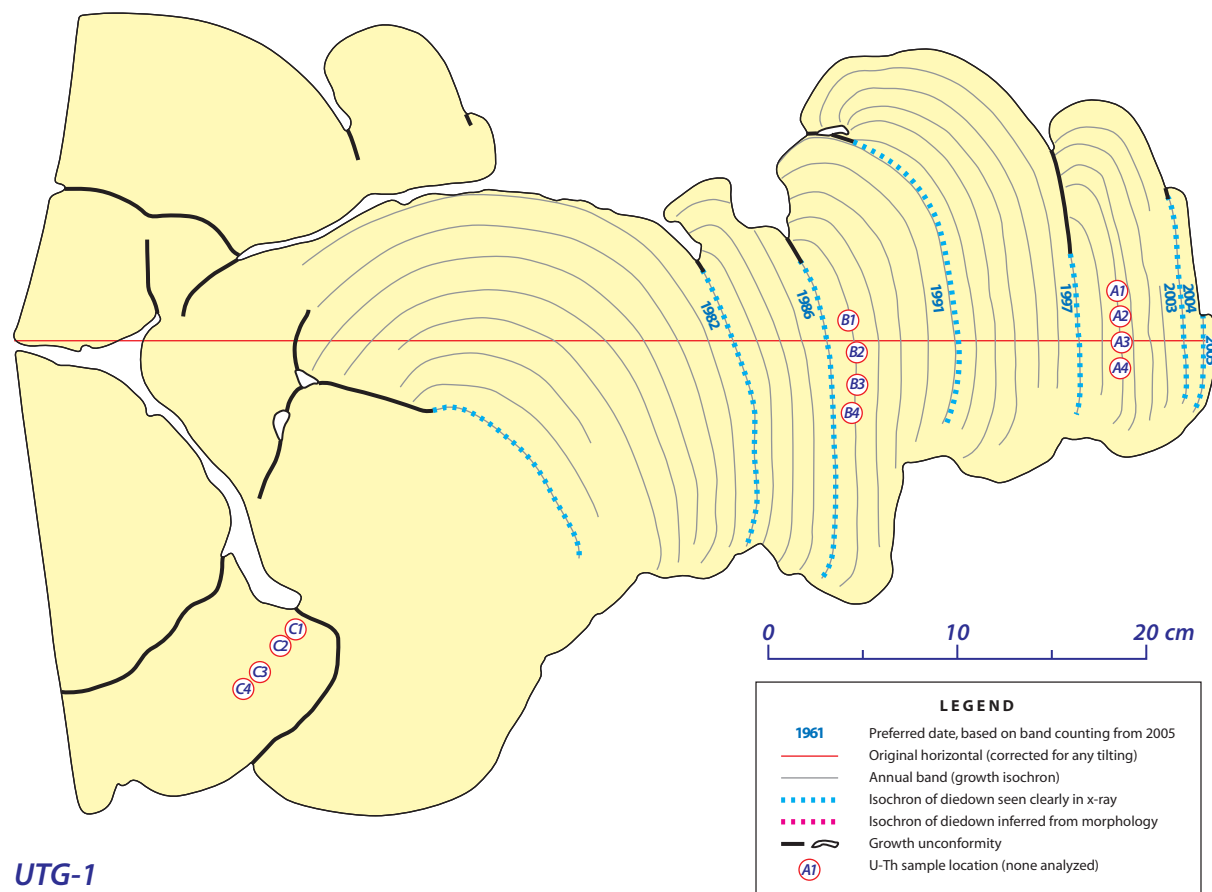


Figure S14. Cross-section of slab UTG-1, from site UTG-A.

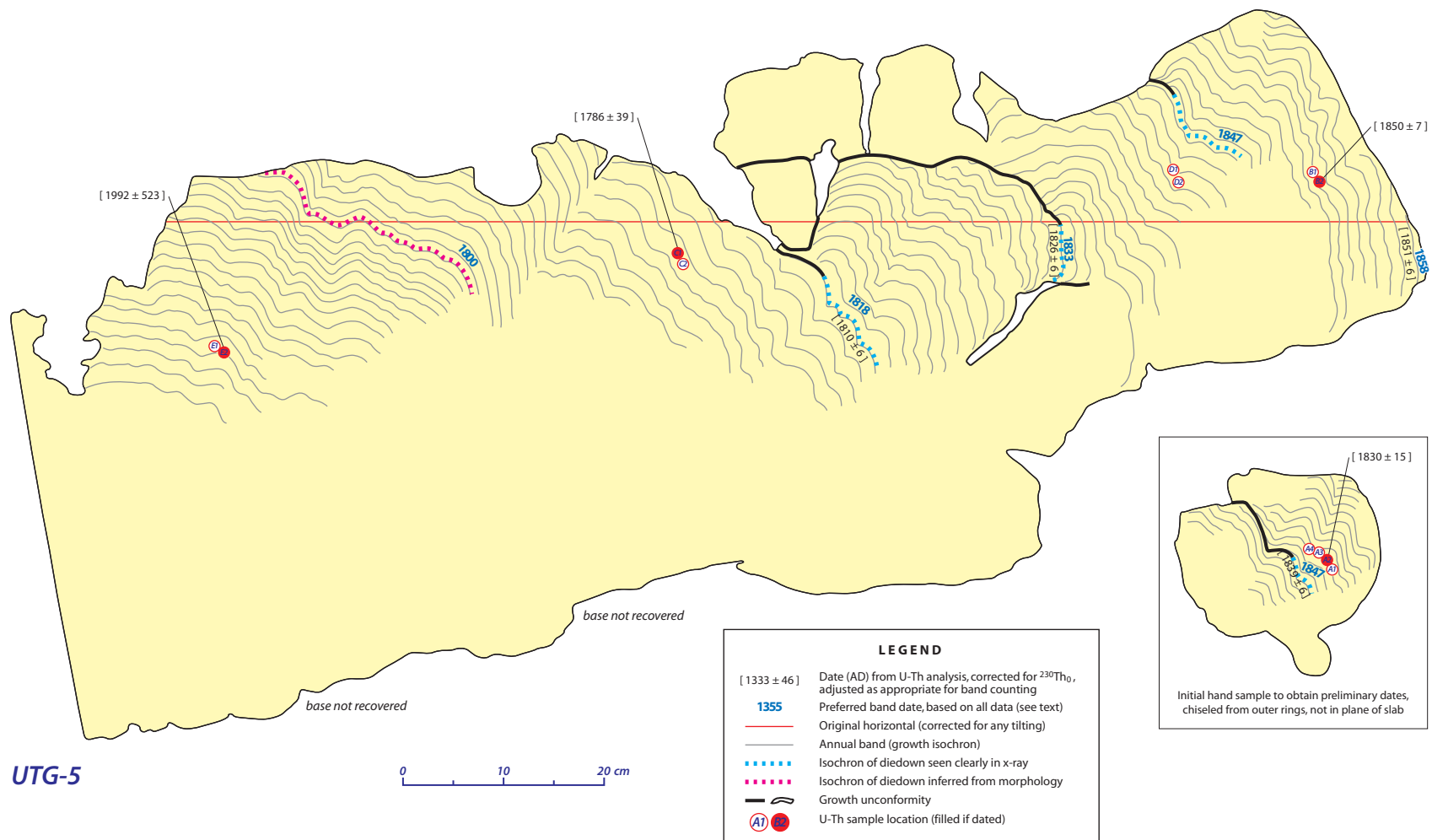


Figure S16. Cross-section of slab UTG-5, from site UTG-A.

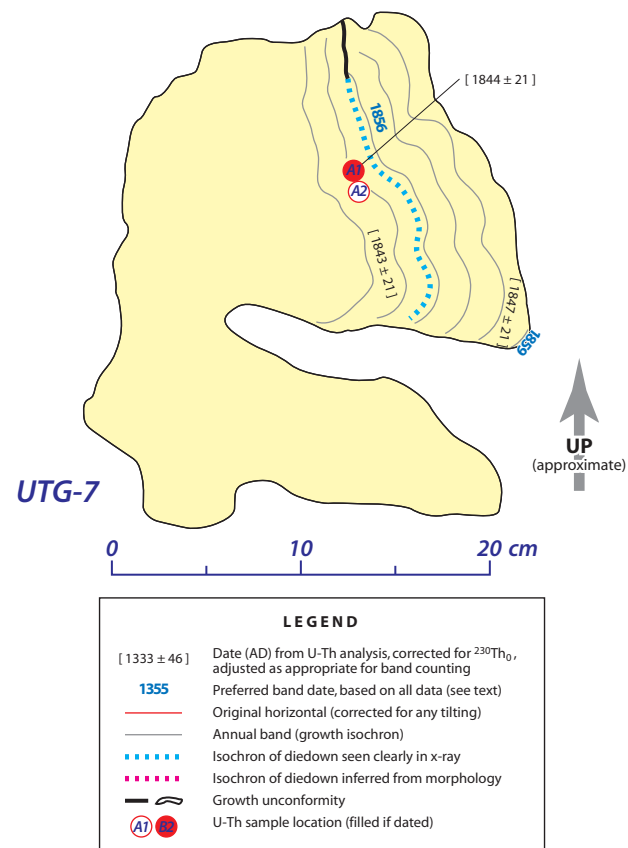


Figure S18. Cross-section of slab UTG-7, from site UTG-A.

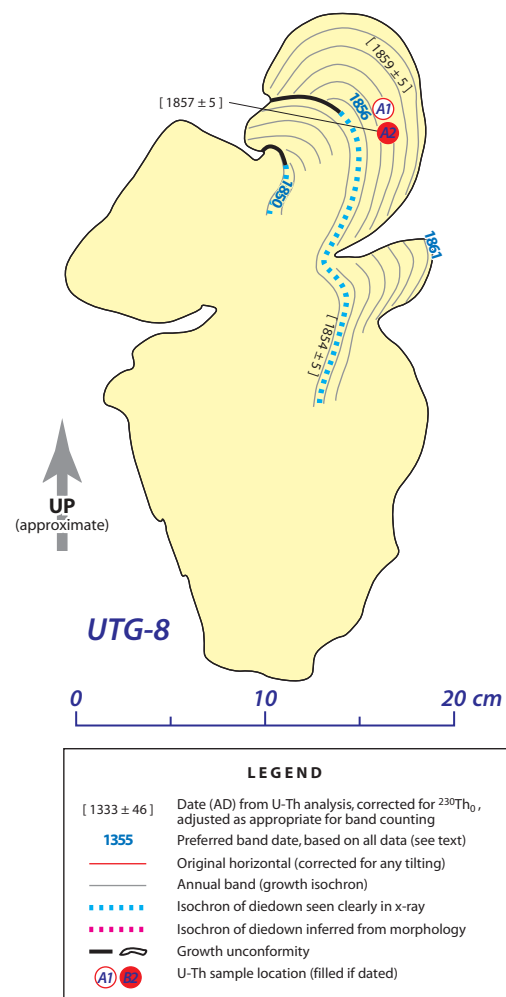


Figure S19. Cross-section of slab UTG-8, from site UTG-A.

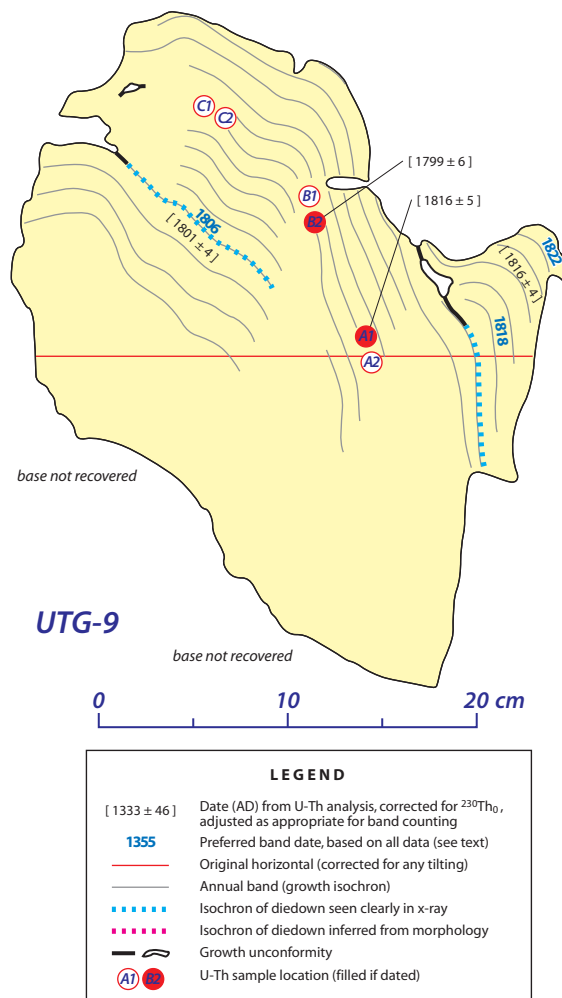


Figure S20. Cross-section of slab UTG-9, from site UTG-A.

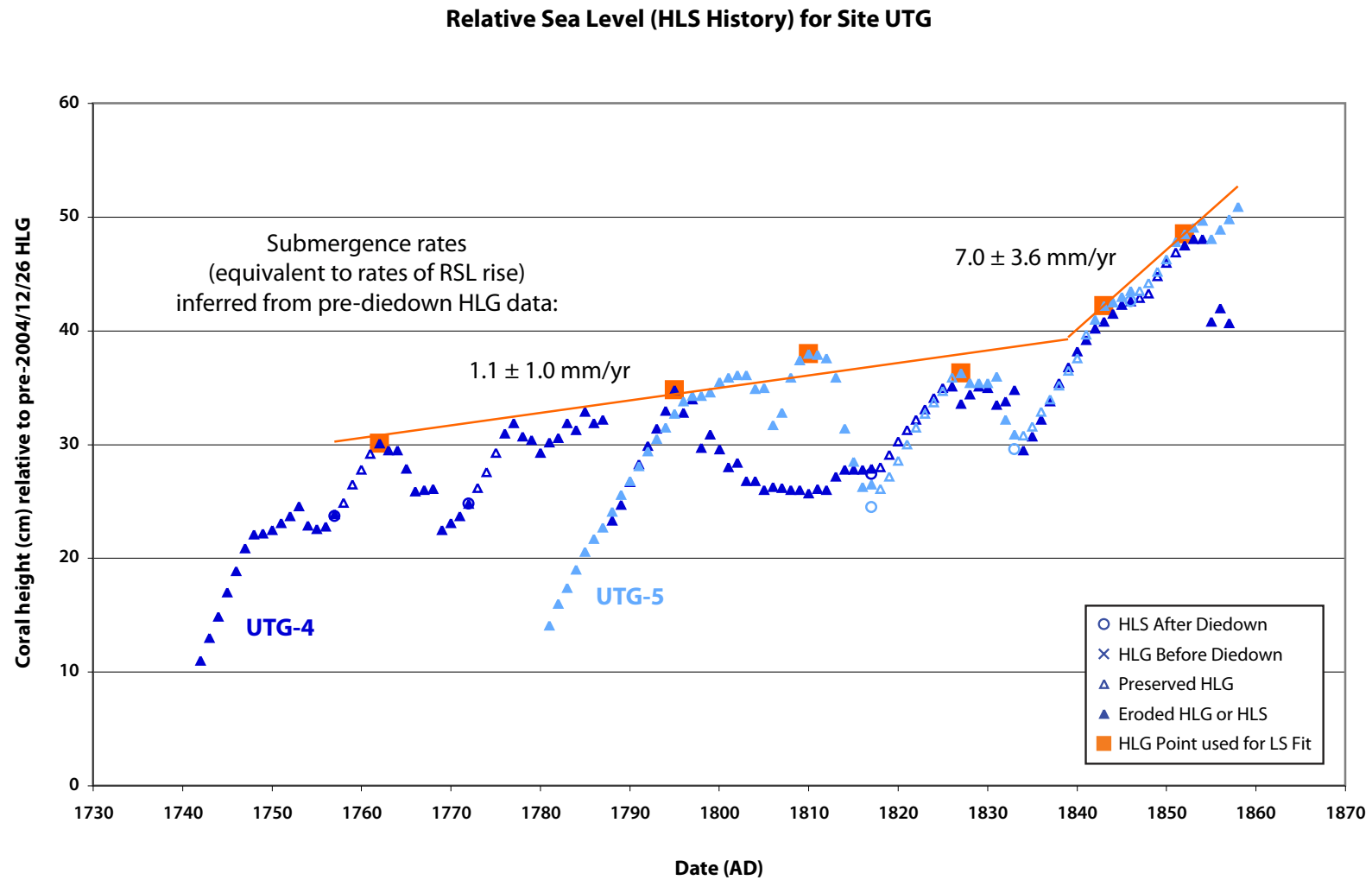


Figure S21. Relative sea level history derived from slabs UTG-4 and UTG-5. Different colors represent data from different corals at the site.

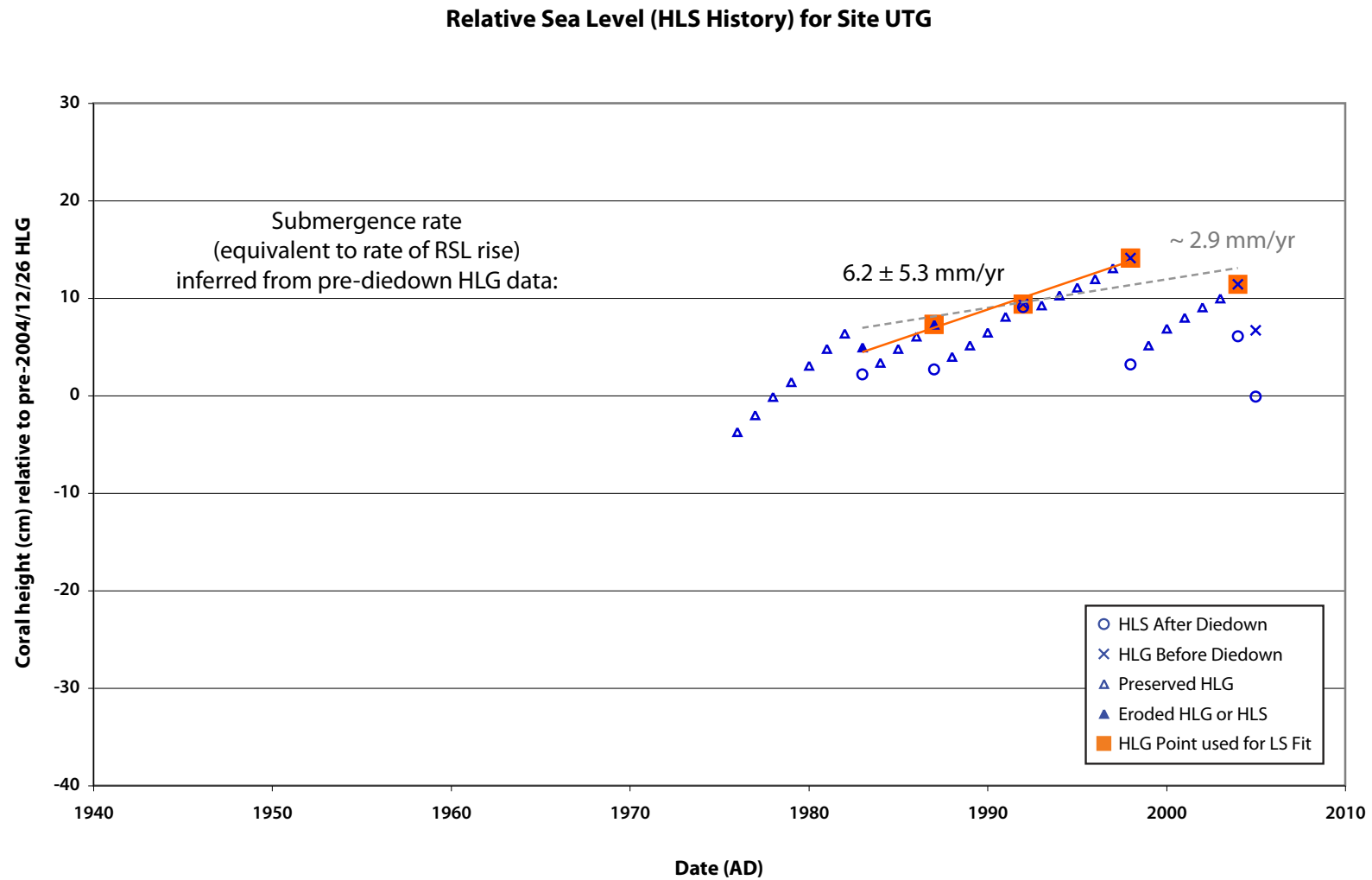


Figure S22. Relative sea level history derived from slab UTG-1.

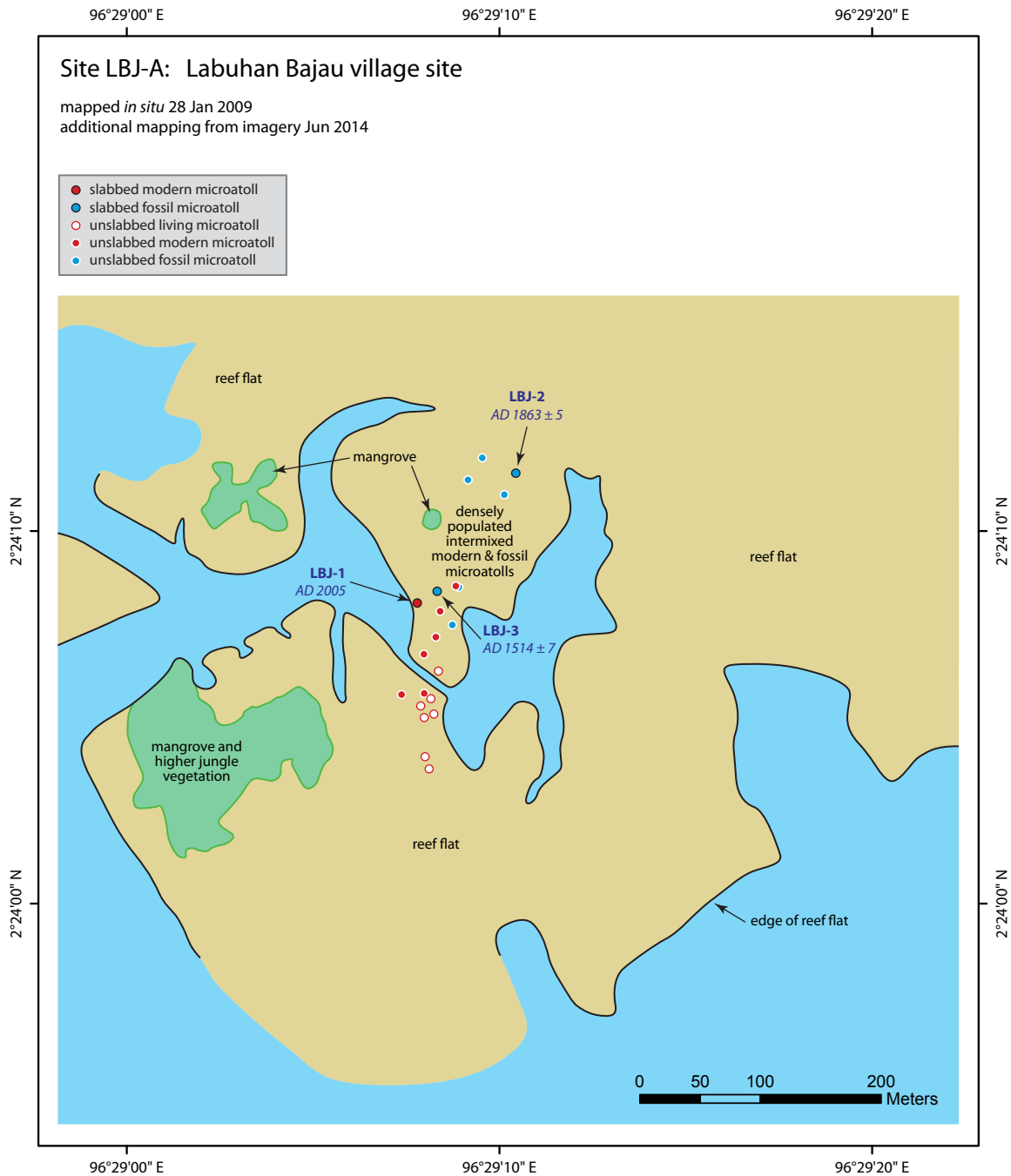


Figure S23. Map of site LBJ-A, east coast of Simeulue, showing sampled microatolls and the date of each microatoll's outer band.

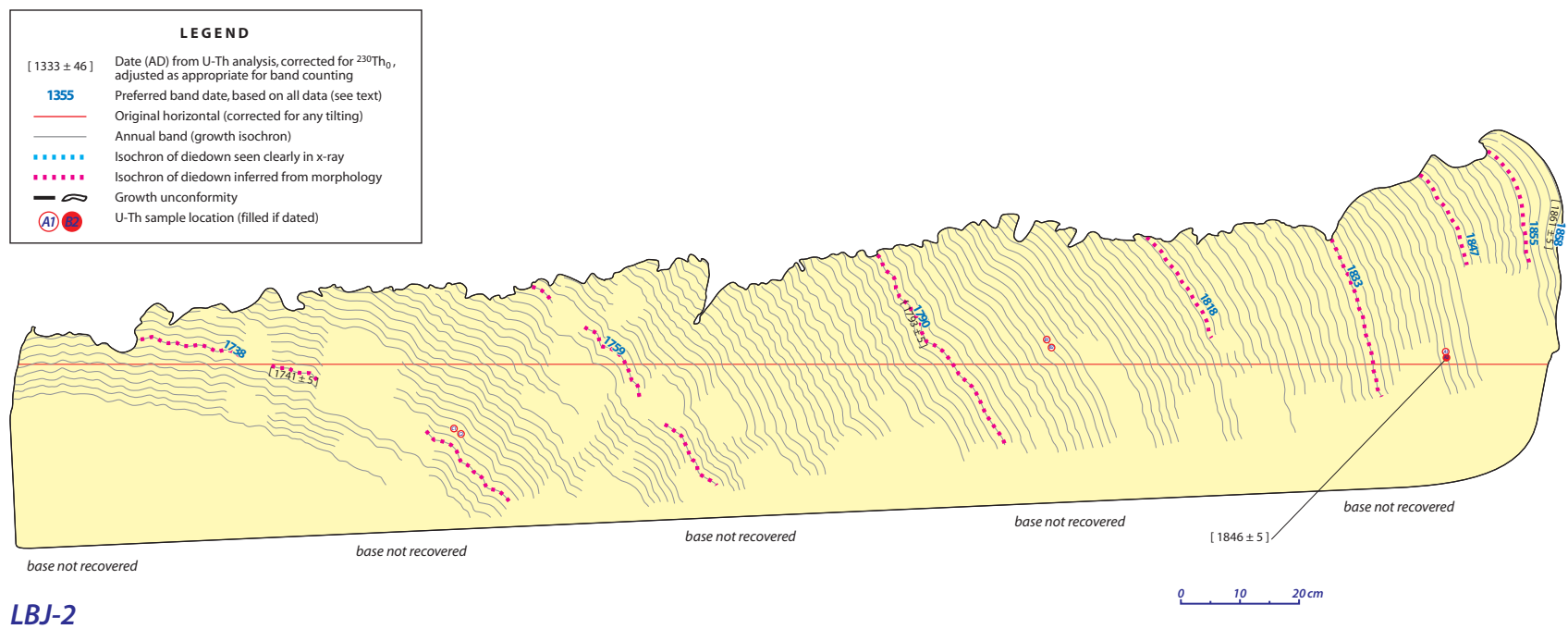


Figure S25. Cross-section of slab LBJ-2, from site LBJ-A.

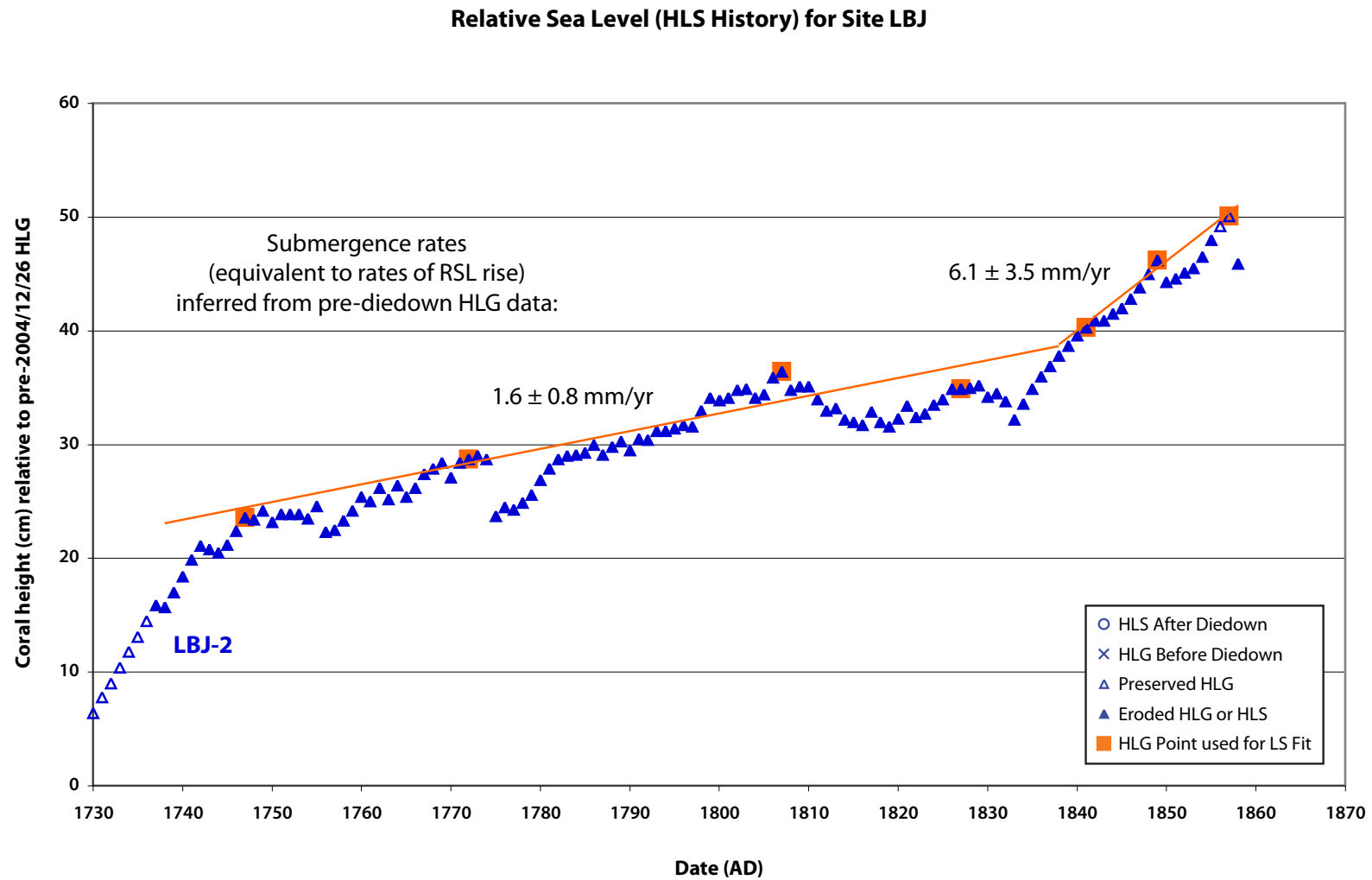


Figure S26. Relative sea level history derived from slab LBJ-2.

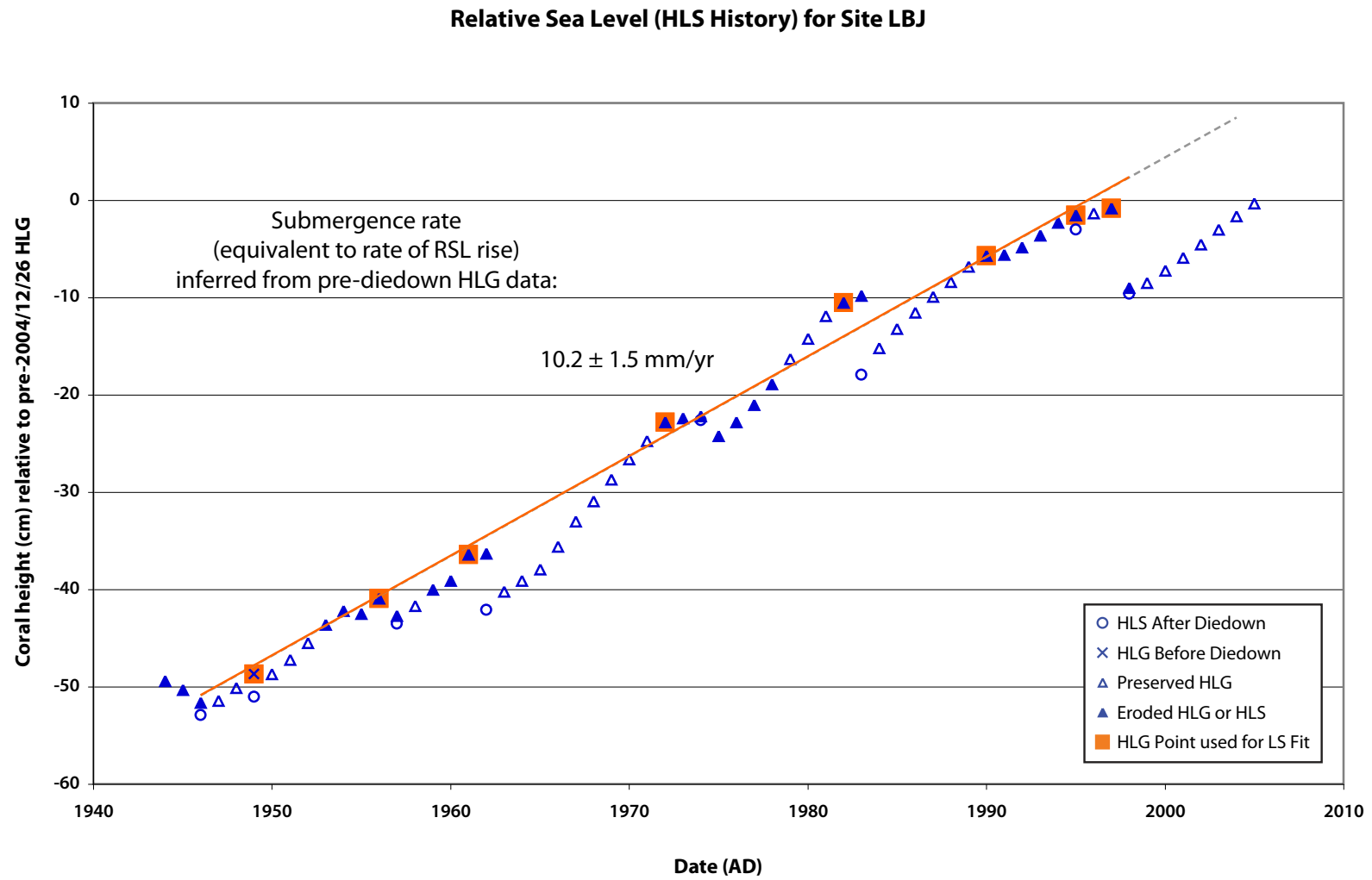


Figure S27. Relative sea level history derived from slab LBJ-1.

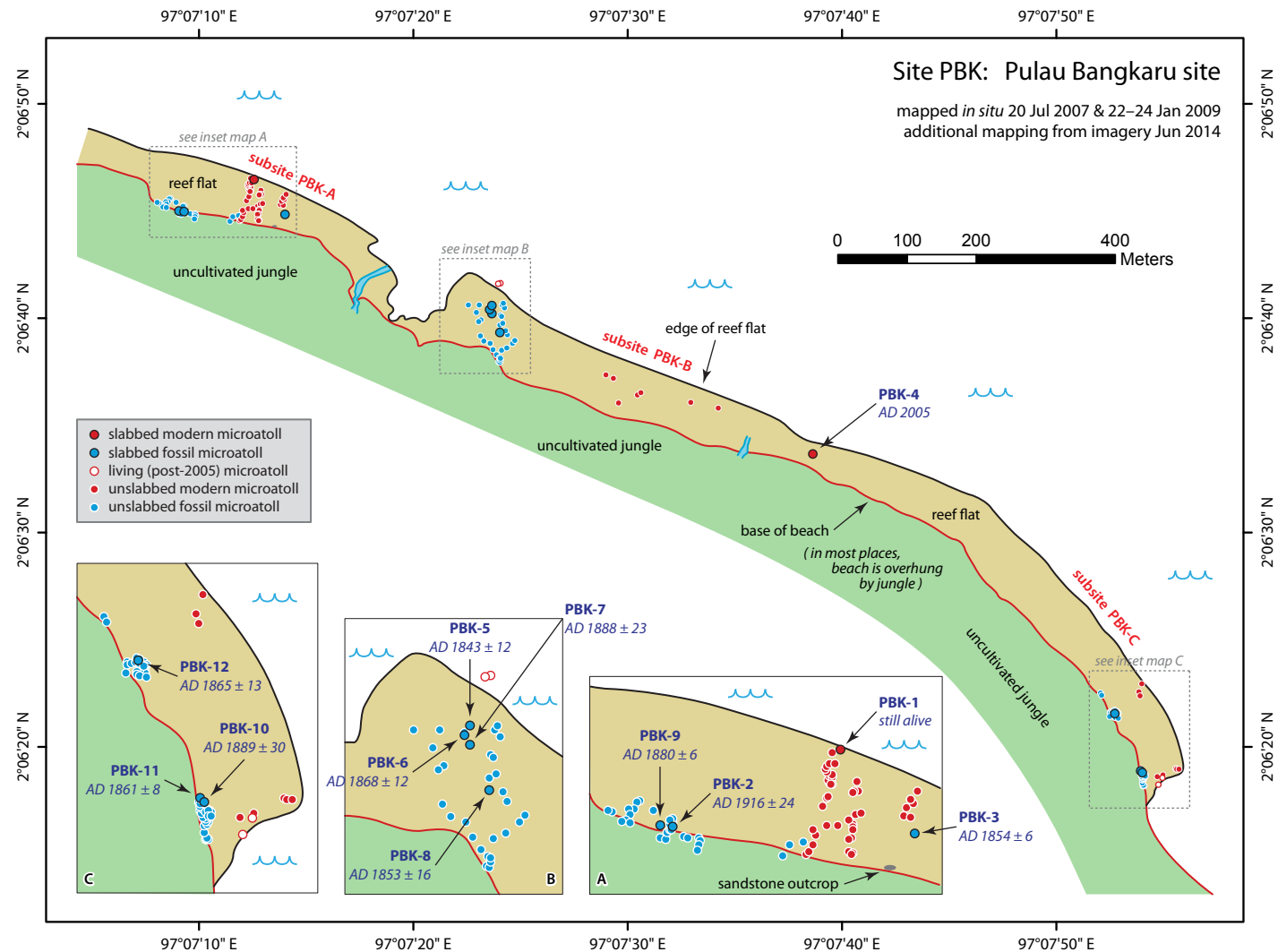


Figure S28. Map of site PBK, northeast coast of Bangkaru, showing sampled microatolls and the date of each microatoll's outer band. Subsites PBK-A, PBK-B, and PBK-C are indicated and mapped in greater detail. Features on each inset map are enlarged at 240%.

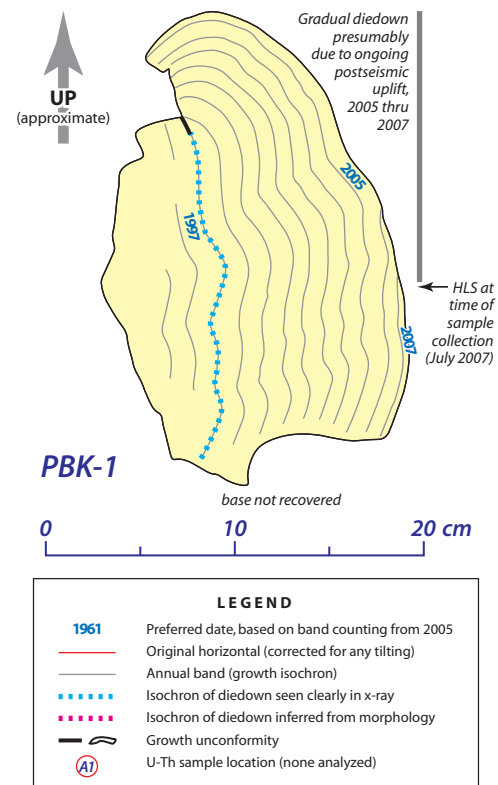


Figure S29. Cross-section of slab PBK-1, from site PBK-A.

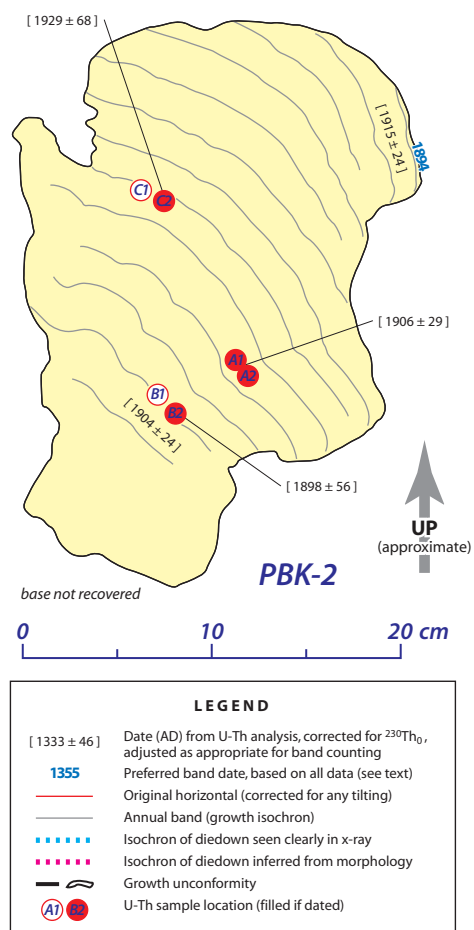


Figure S30. Cross-section of slab PBK-2, from site PBK-A.

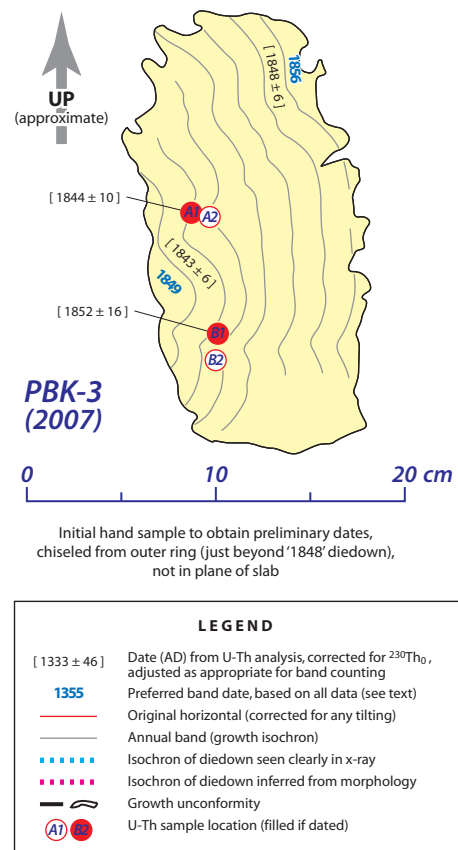


Figure S31. Cross-section of slab PBK-3 (2007 hand sample), from site PBK-A.

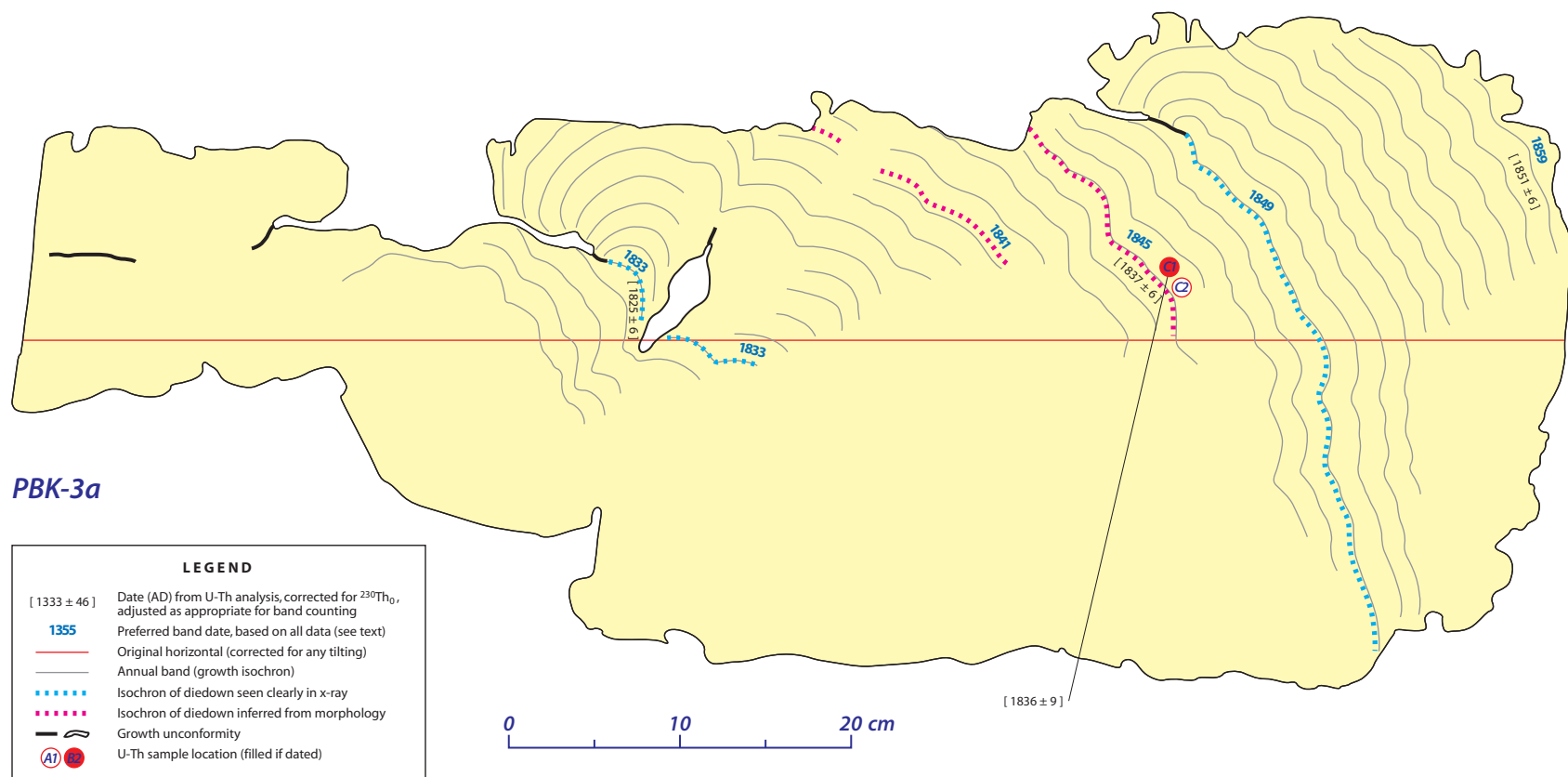


Figure S32. Cross-section of slab PBK-3 (slice a), from site PBK-A.

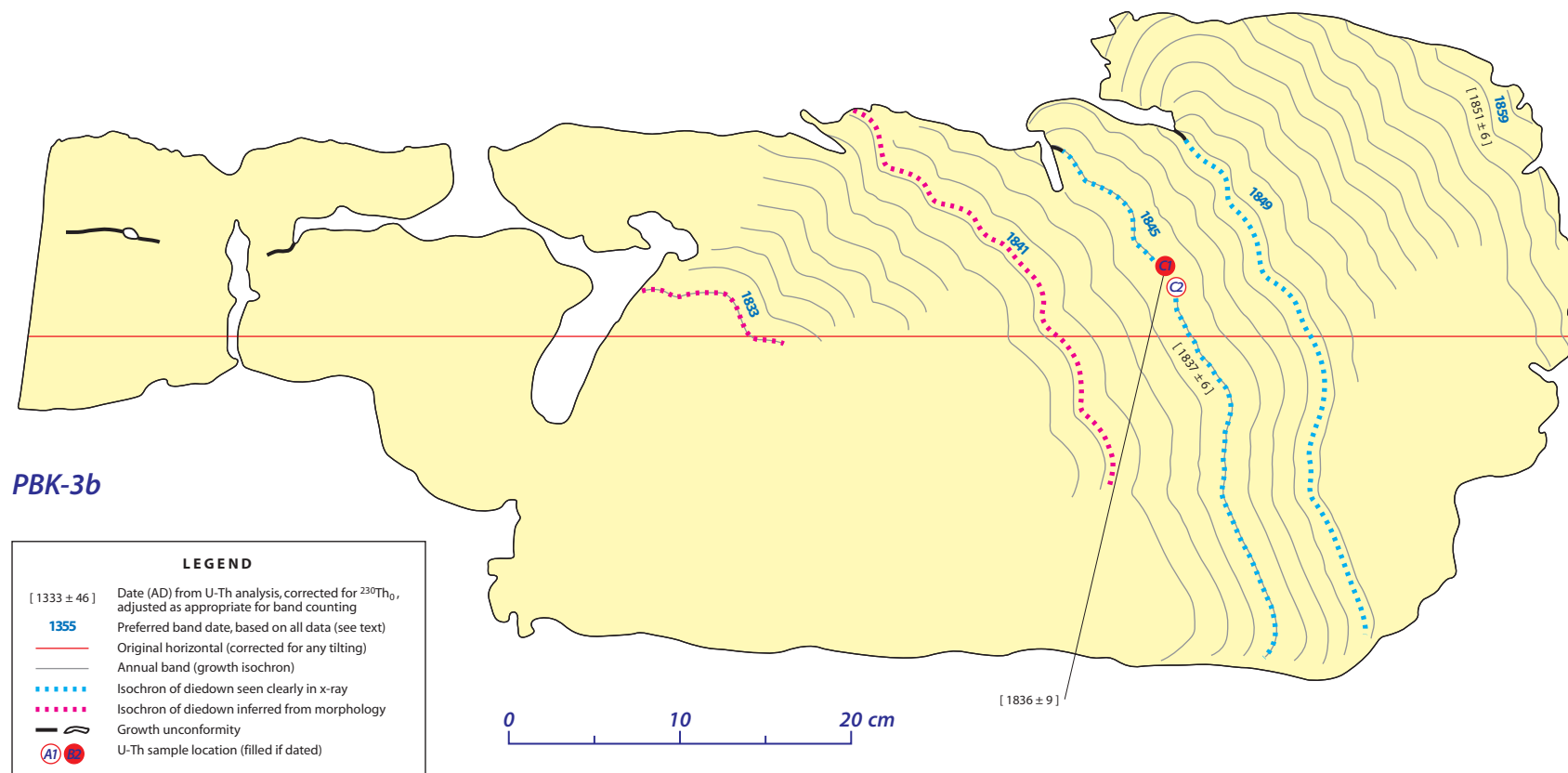


Figure S33. Cross-section of slab PBK-3 (slice b), from site PBK-A.

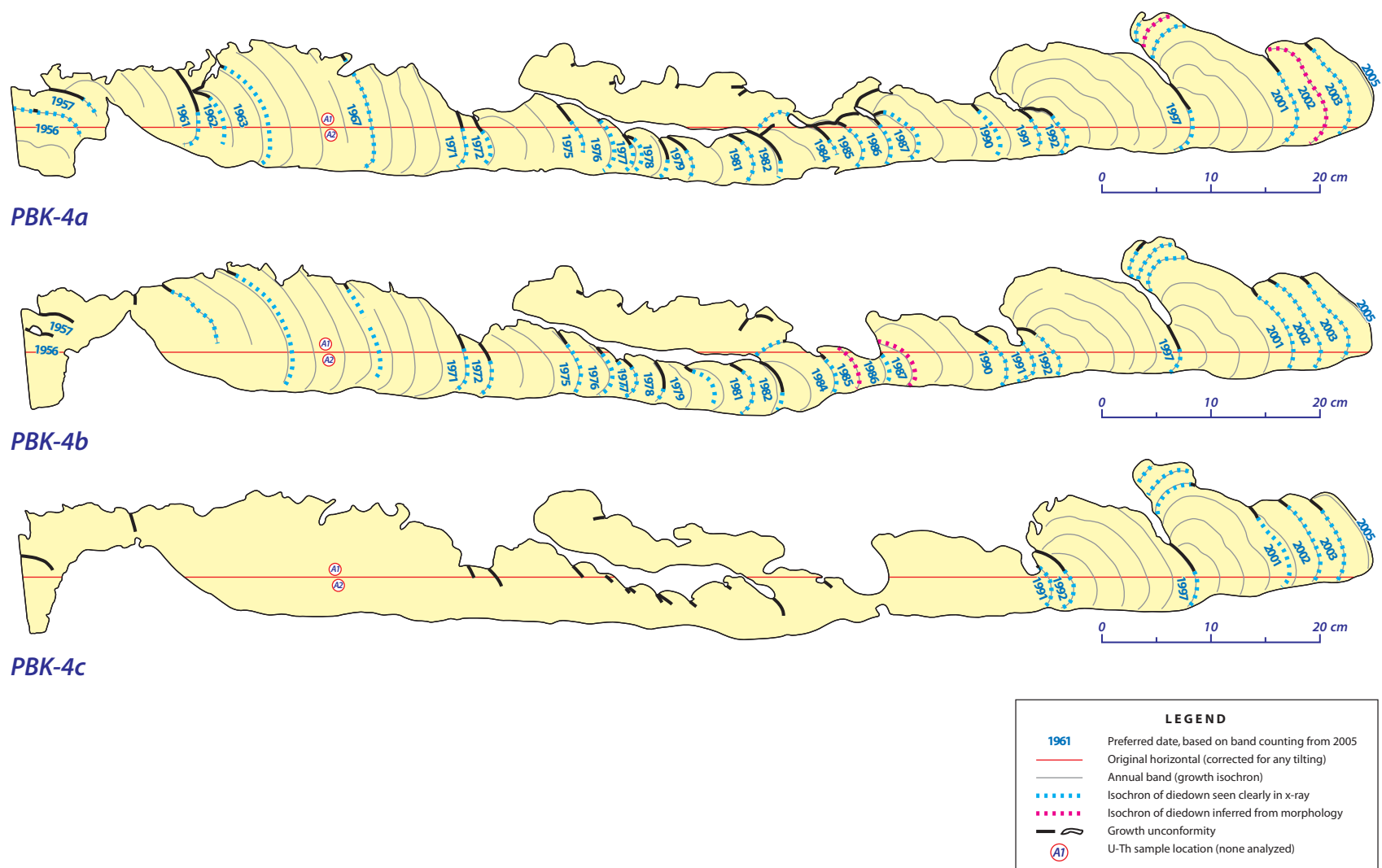


Figure S34. Cross-sections of slab PBK-4 (slices a, b, and c), from site PBK-B.

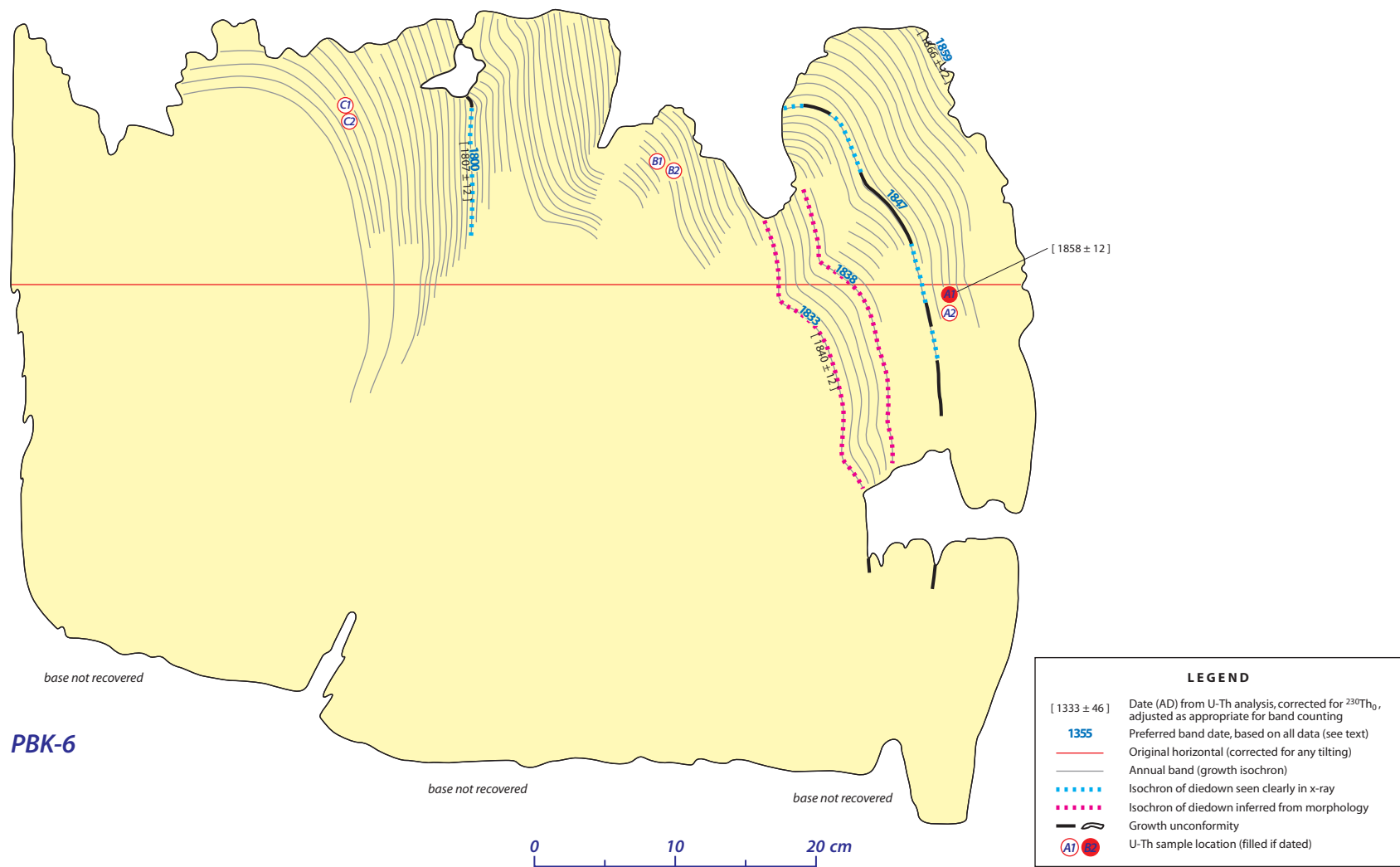


Figure S36. Cross-section of slab PBK-6, from site PBK-B.

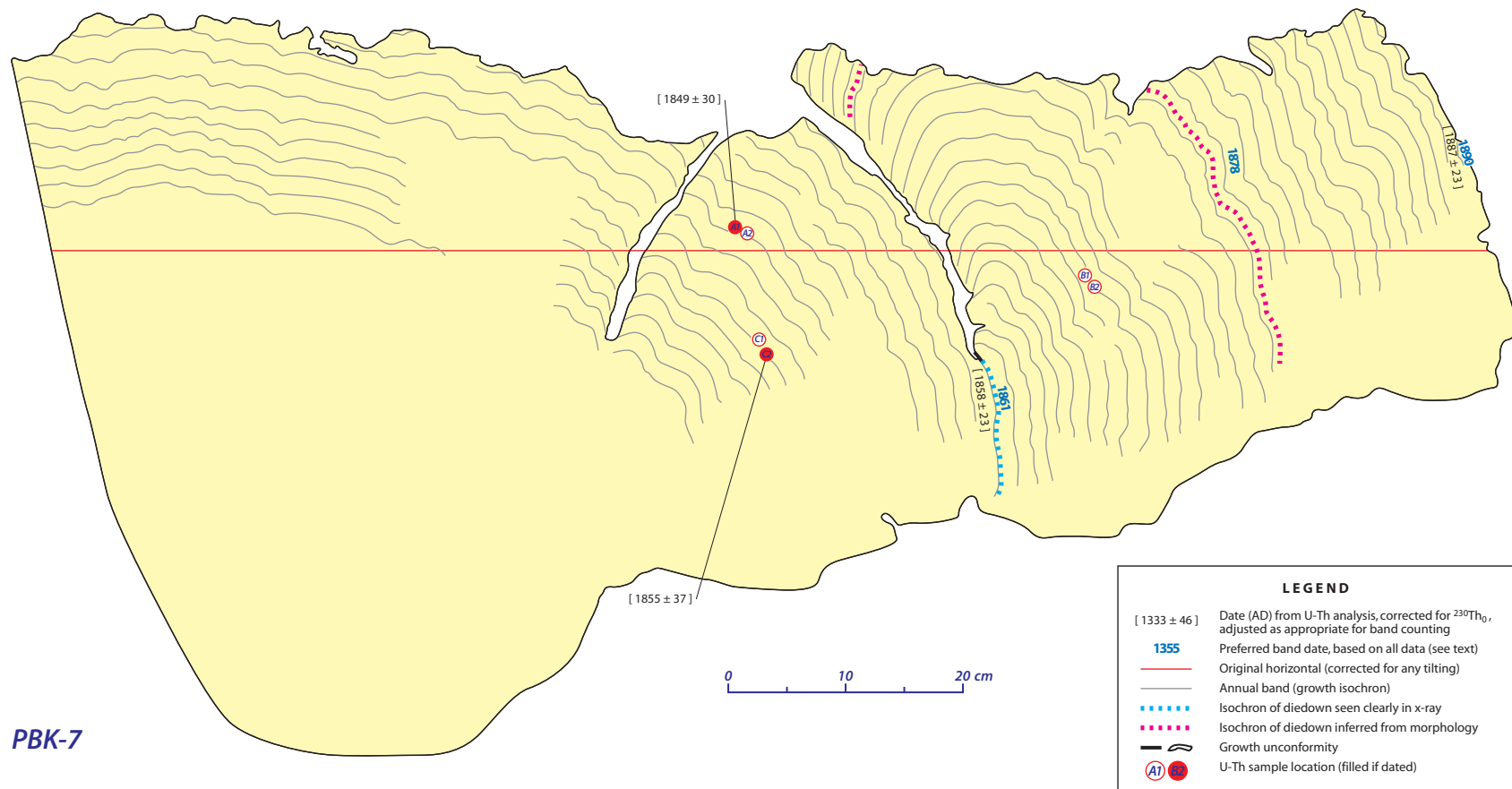


Figure S37. Cross-section of slab PBK-7, from site PBK-B.

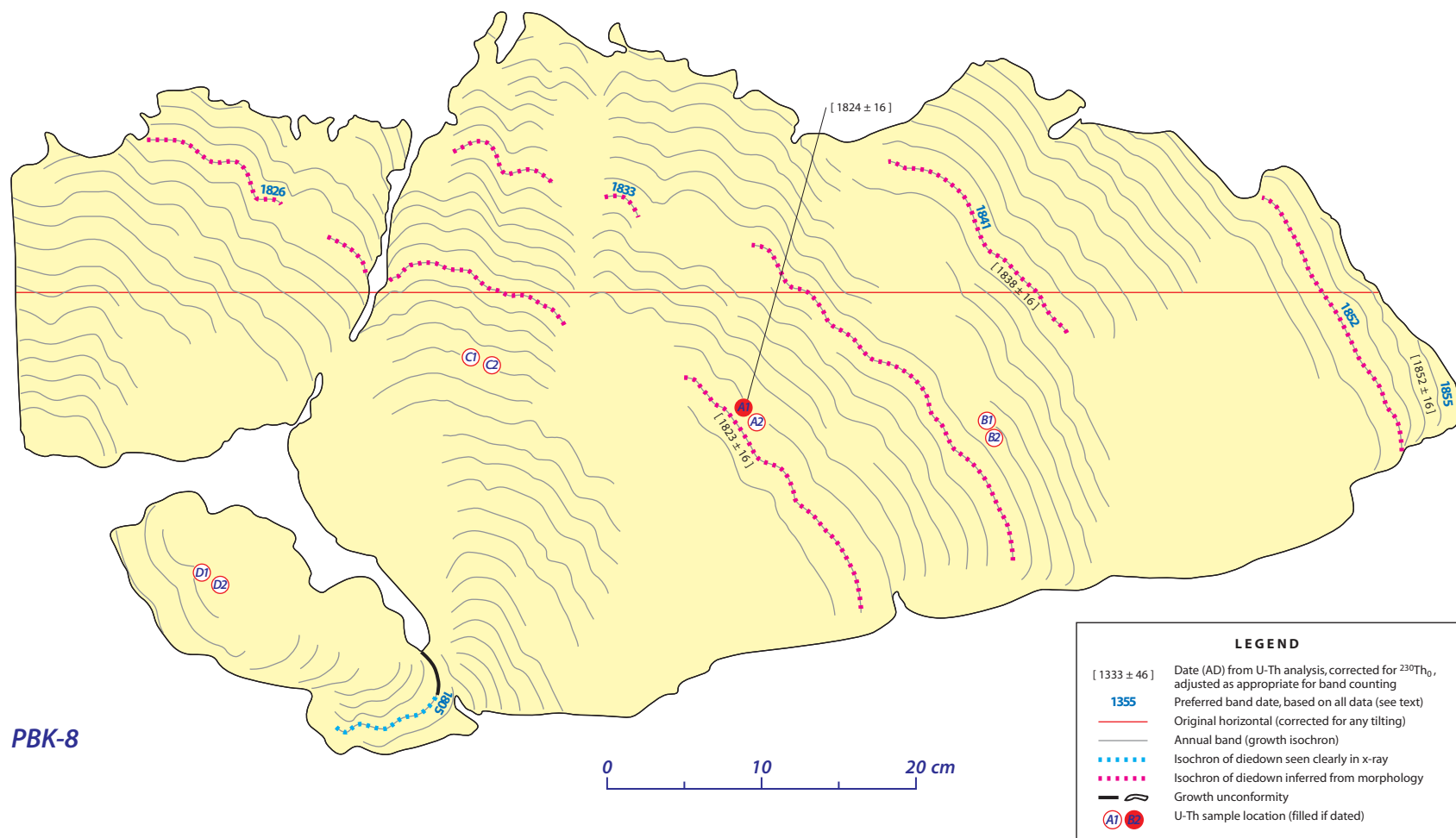


Figure S38. Cross-section of slab PBK-8, from site PBK-B.

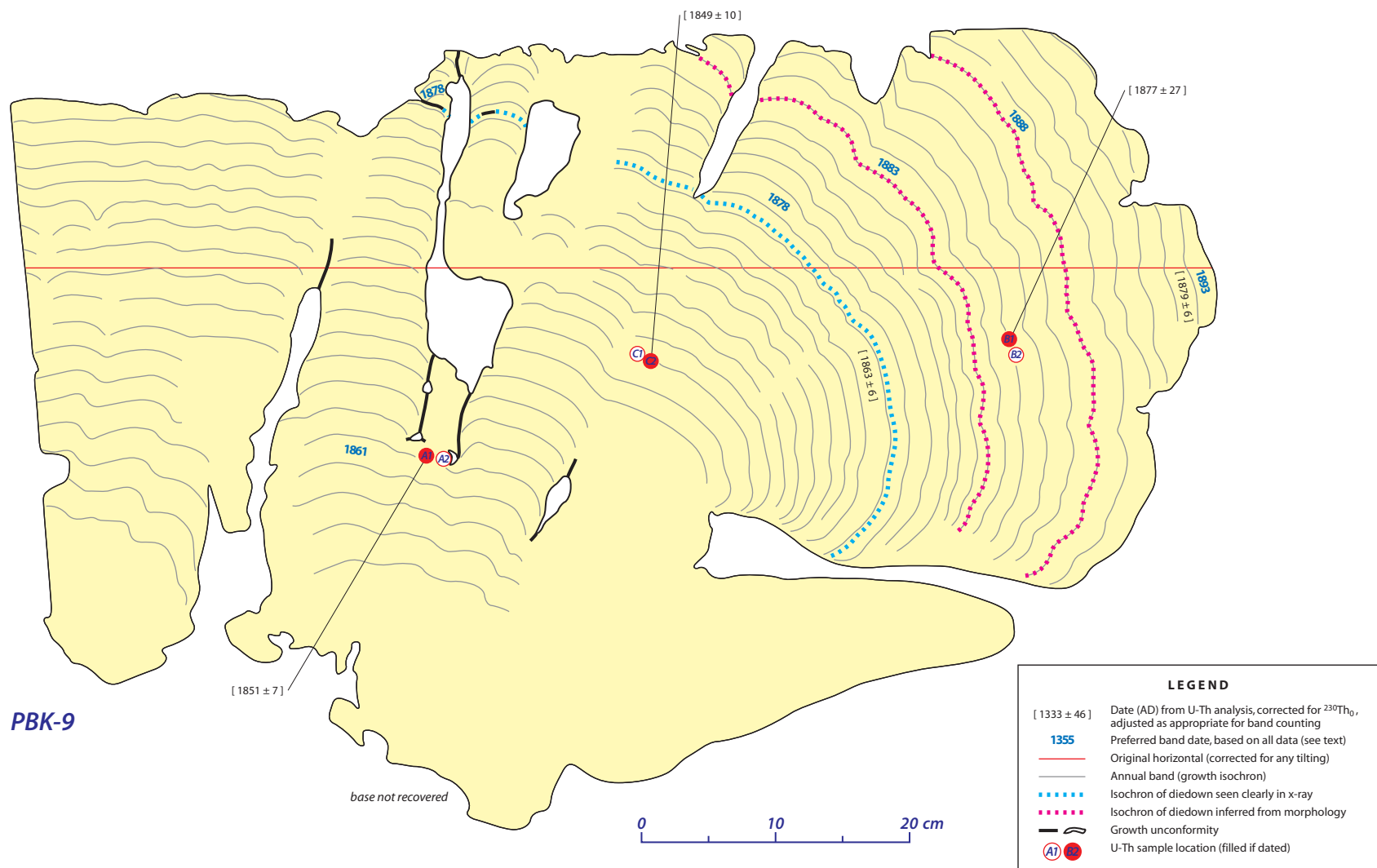


Figure S39. Cross-section of slab PBK-9, from site PBK-A.

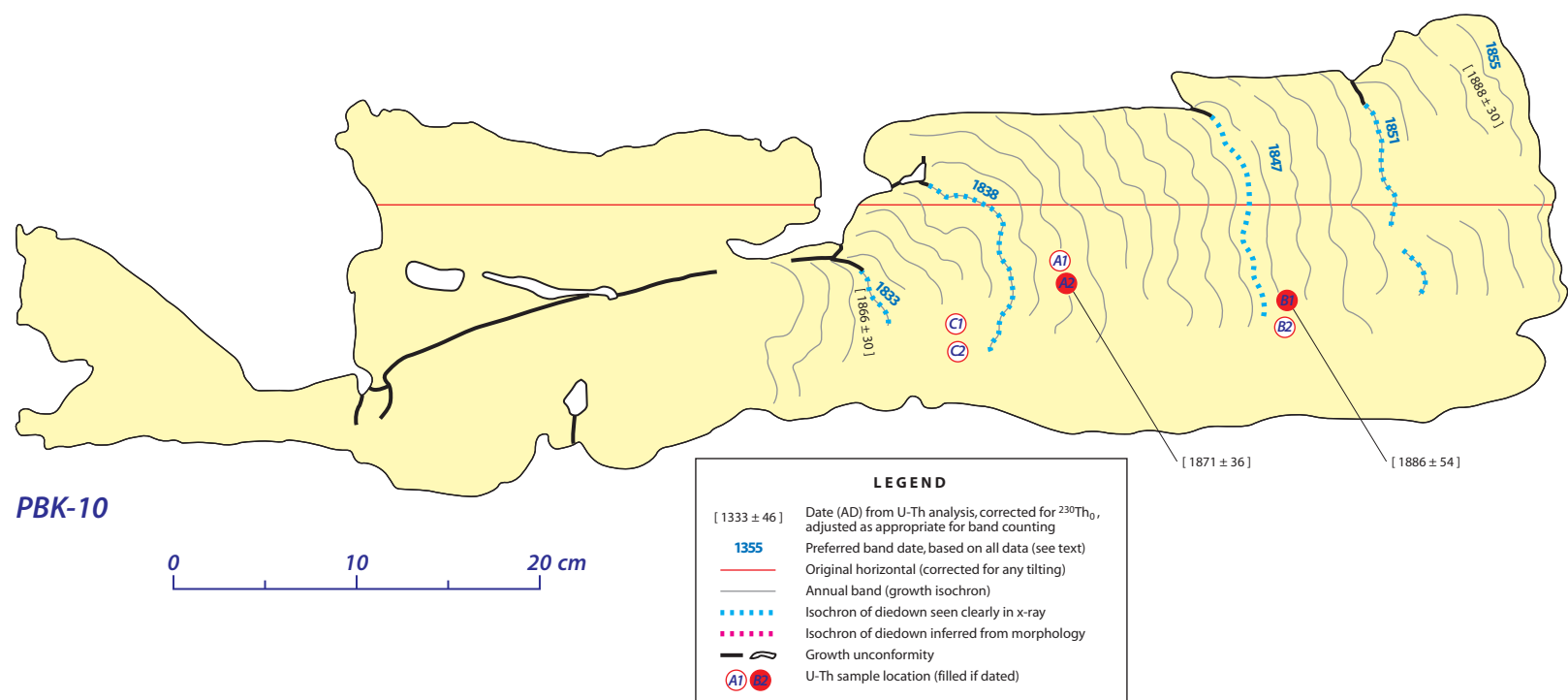


Figure S40. Cross-section of slab PBK-10, from site PBK-C.

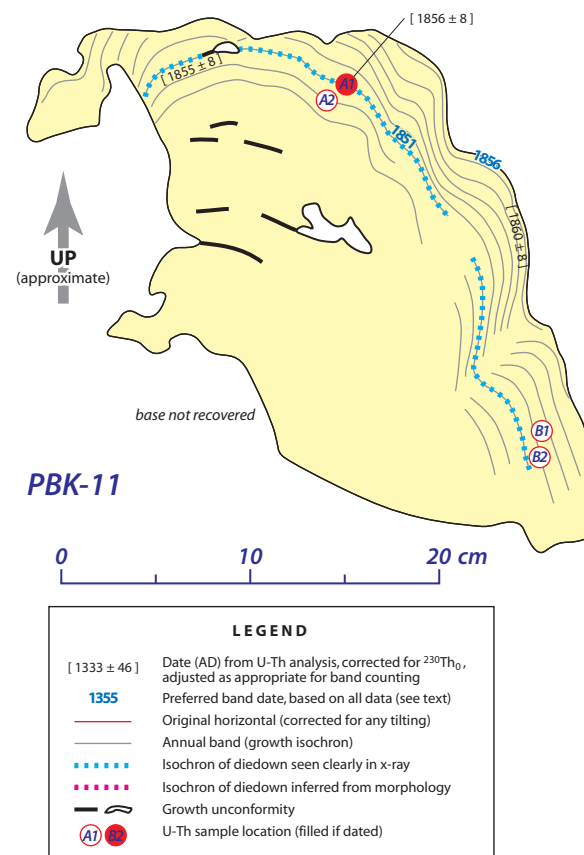


Figure S41. Cross-section of slab PBK-11, from site PBK-C.

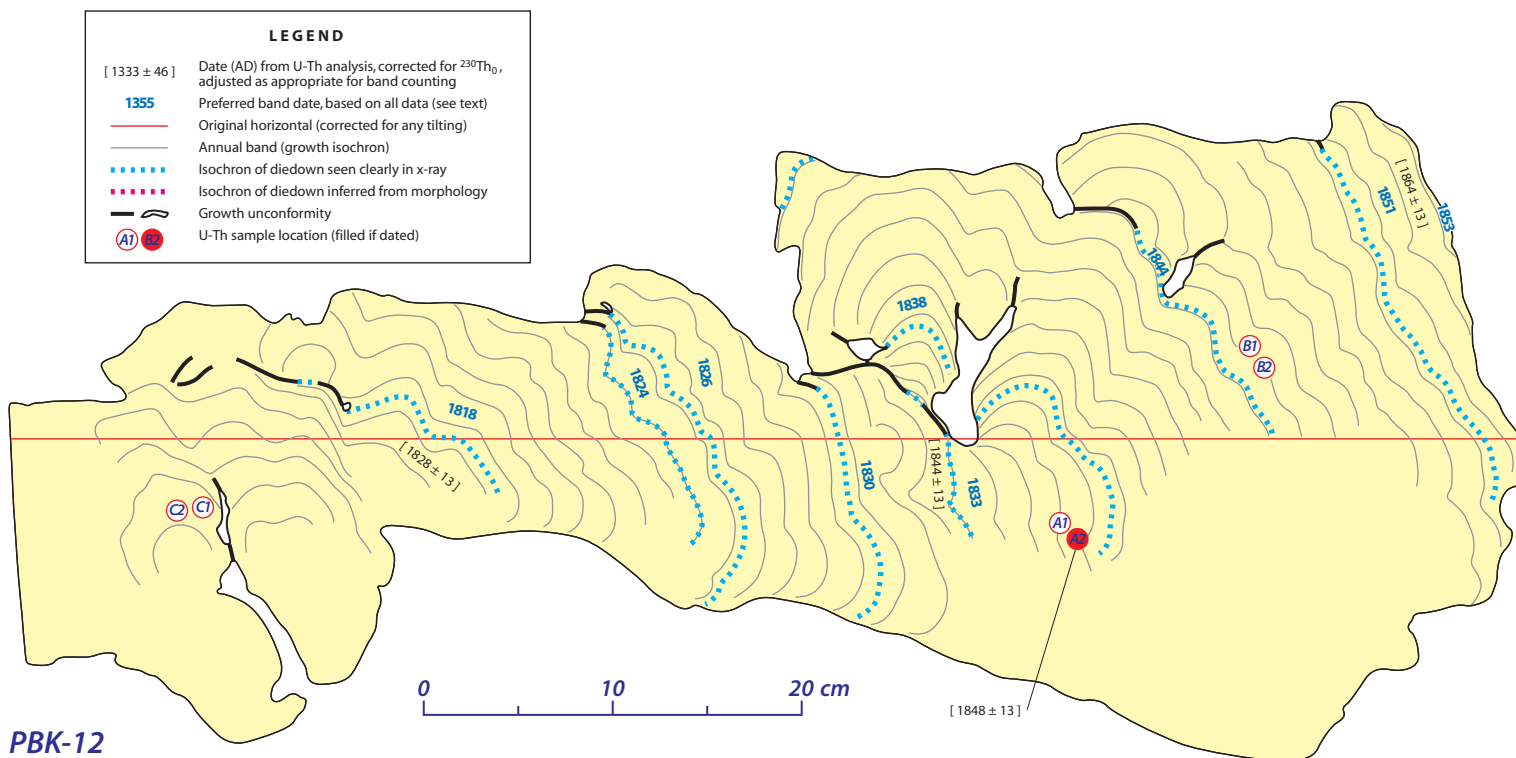


Figure S42. Cross-section of slab PBK-12, from site PBK-C.

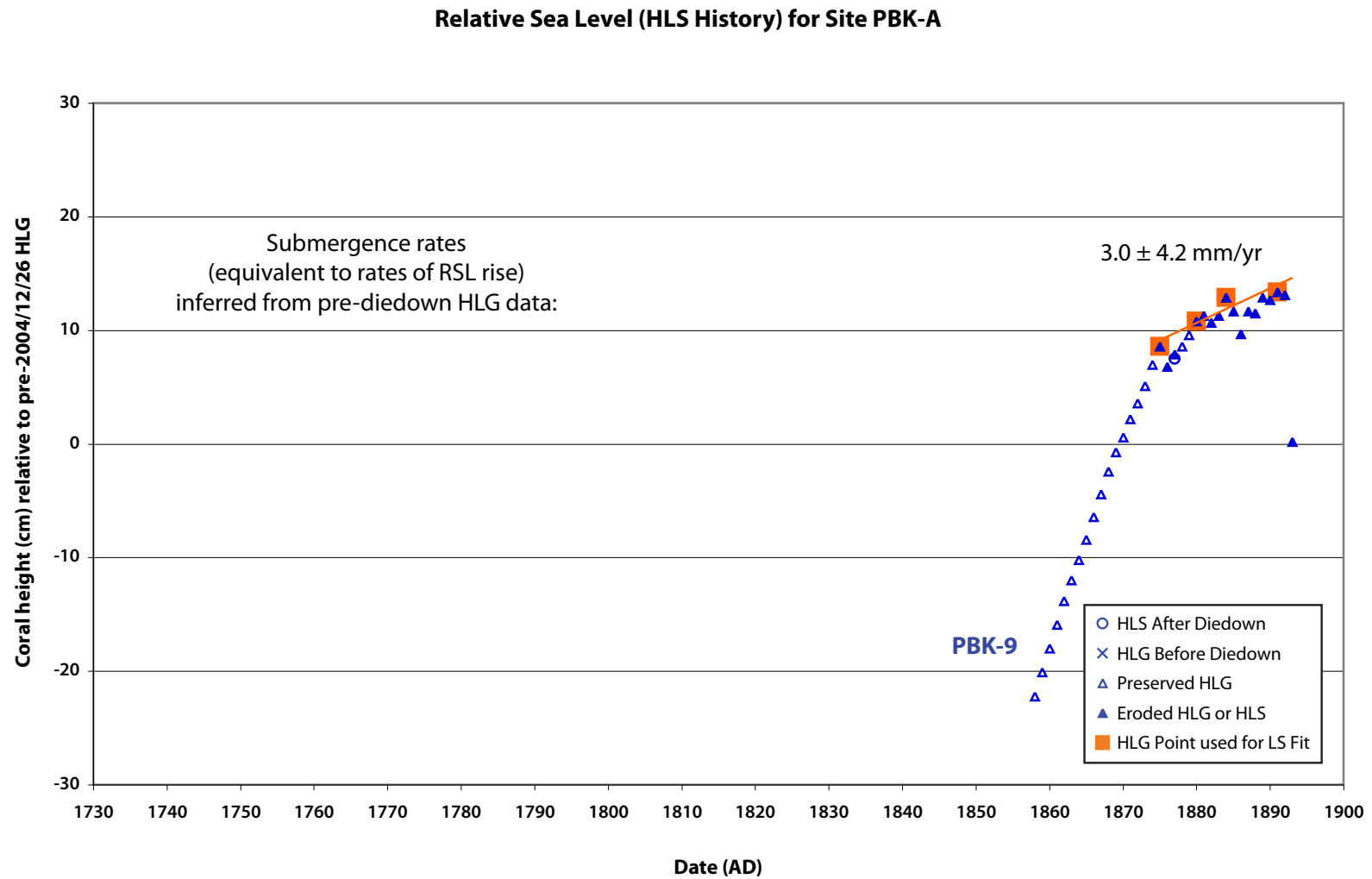


Figure S43. Relative sea level history derived from slab PBK-9.

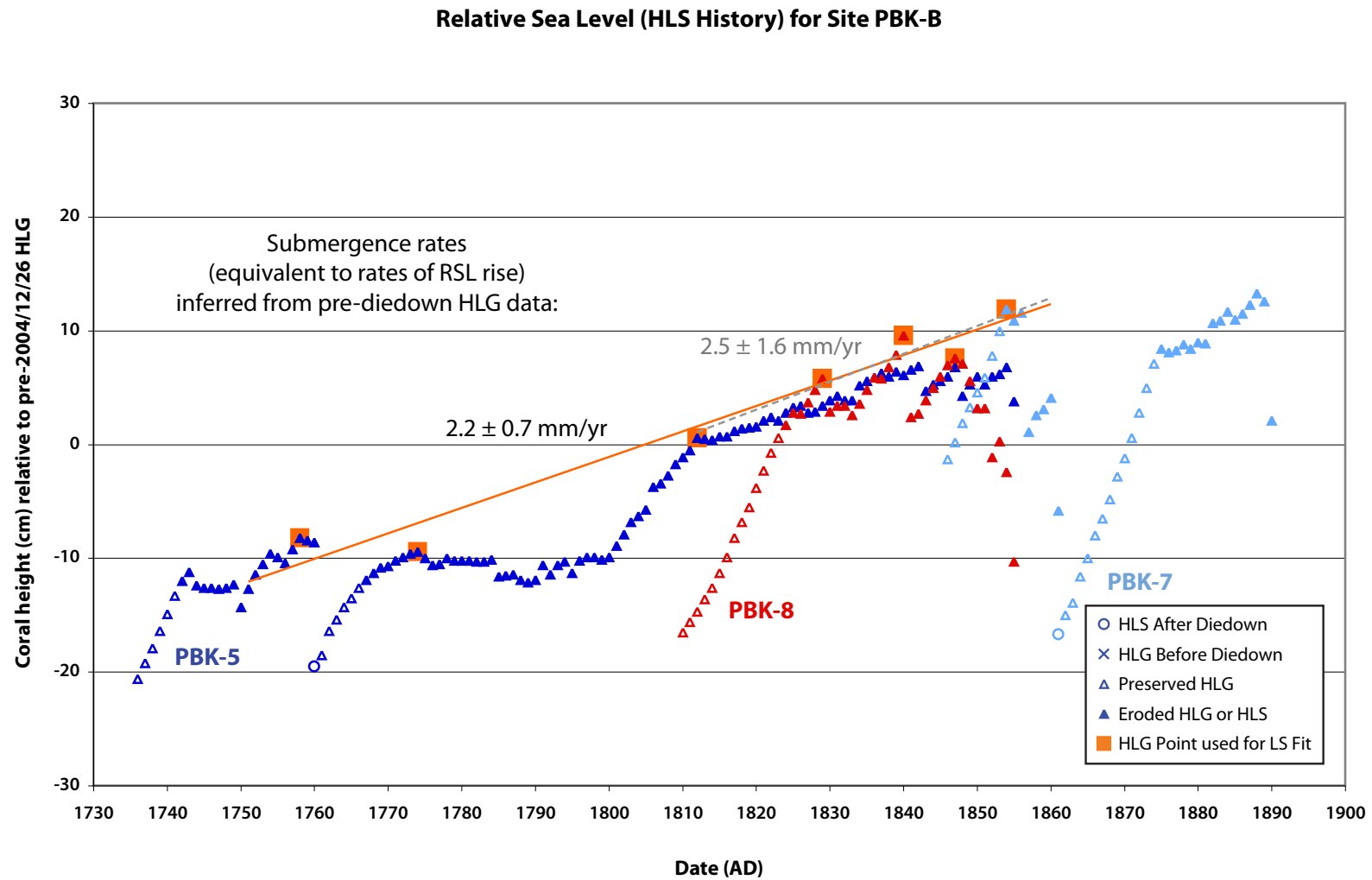


Figure S44. Relative sea level history derived from slabs PBK-5, PBK-7, and PBK-8. Different colors represent data from different corals.

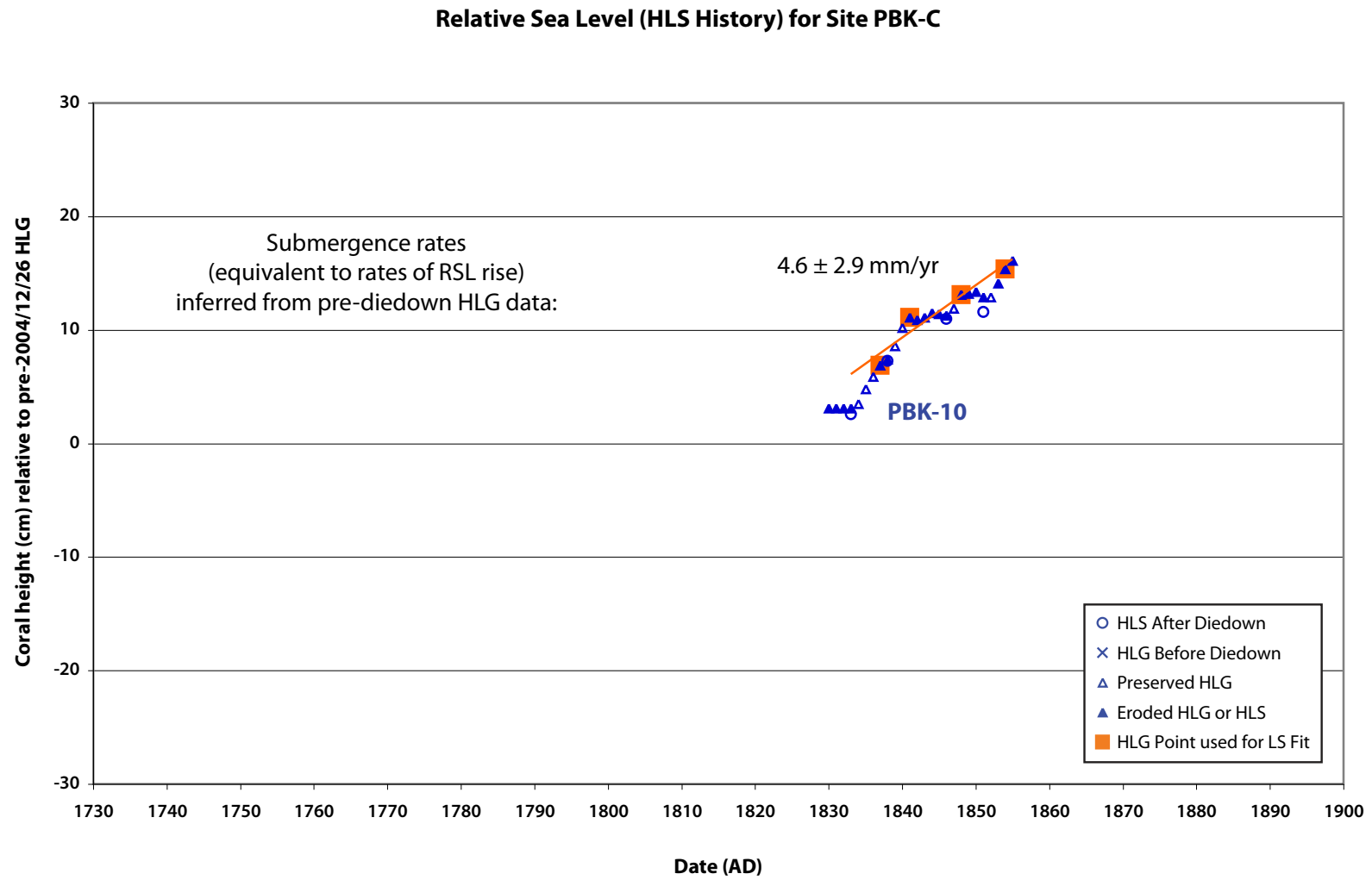


Figure S45. Relative sea level history derived from slab PBK-10.

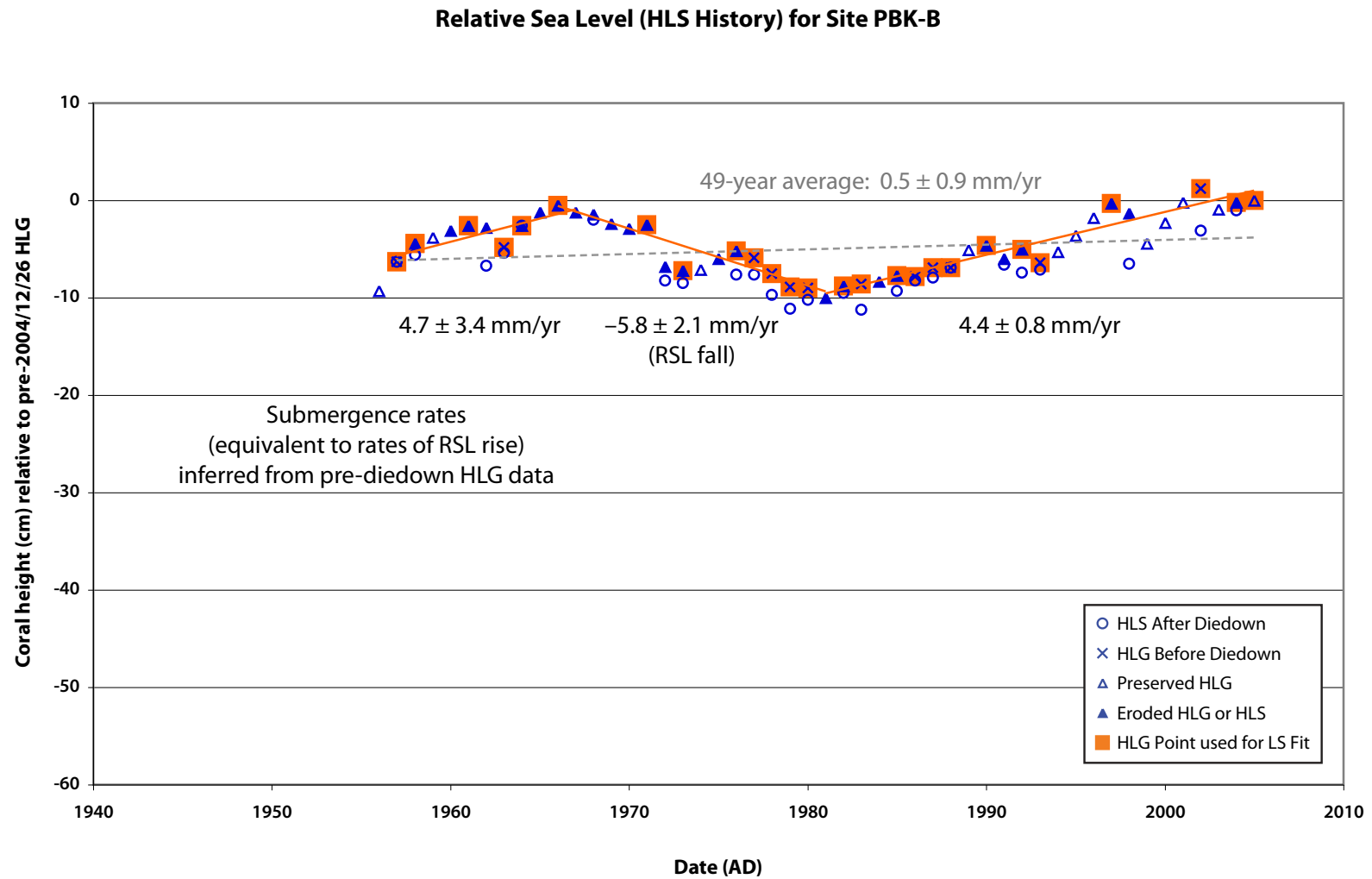


Figure S46. Relative sea level history derived from slab PBK-4.

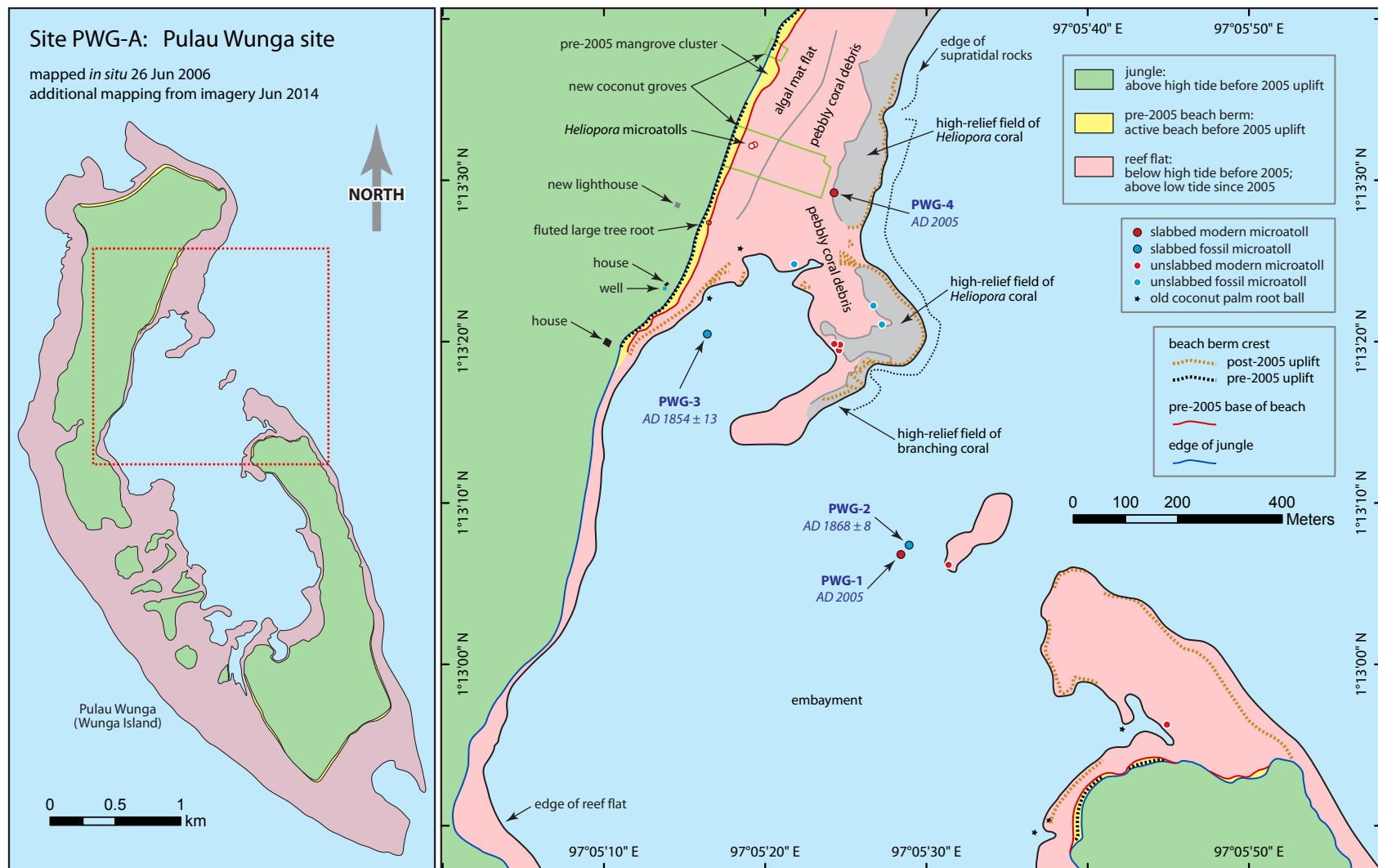


Figure S47. Map of site PWG-A, Pulau Wunga, west of Nias, showing sampled microatolls and the date of each microatoll's outer band. *Right:* Site map. *Left:* Index map of all of Wunga island; red box shows location of detailed site map on the right.

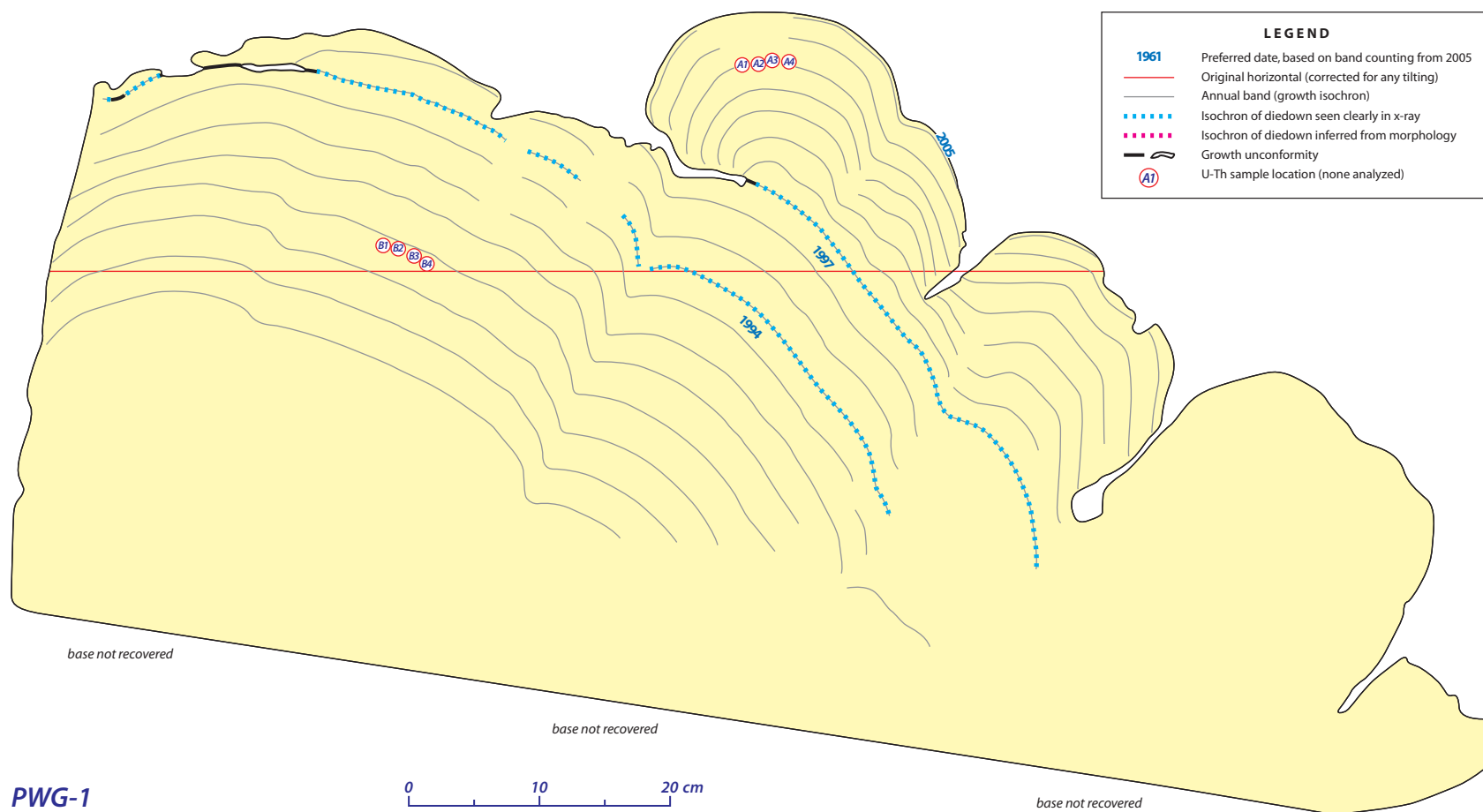


Figure S48. Cross-section of slab PWG-1, from site PWG-A.

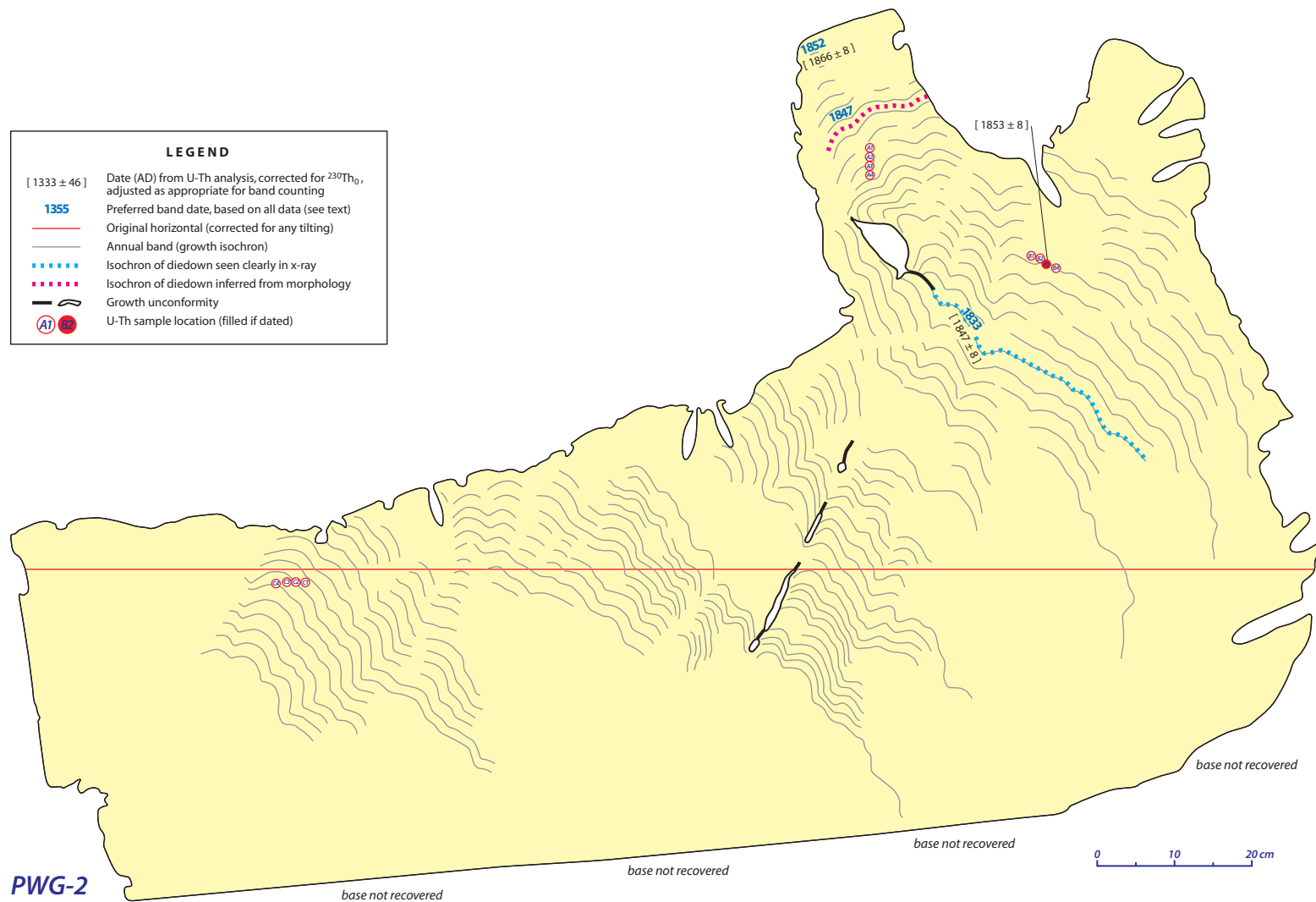


Figure S49. Cross-section of slab PWG-2, from site PWG-A.

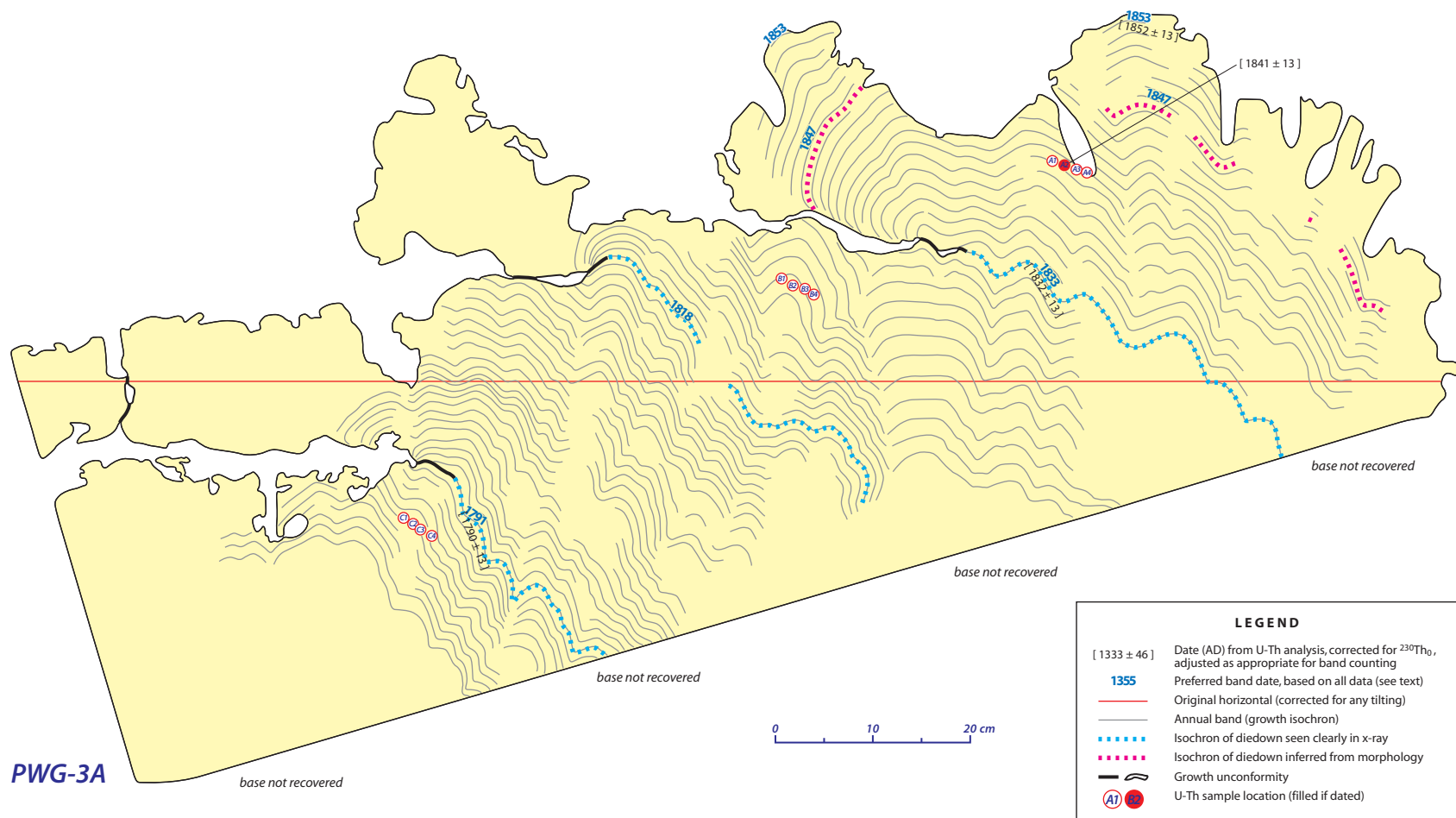


Figure S50. Cross-section of slab PWG-3A, from site PWG-A.

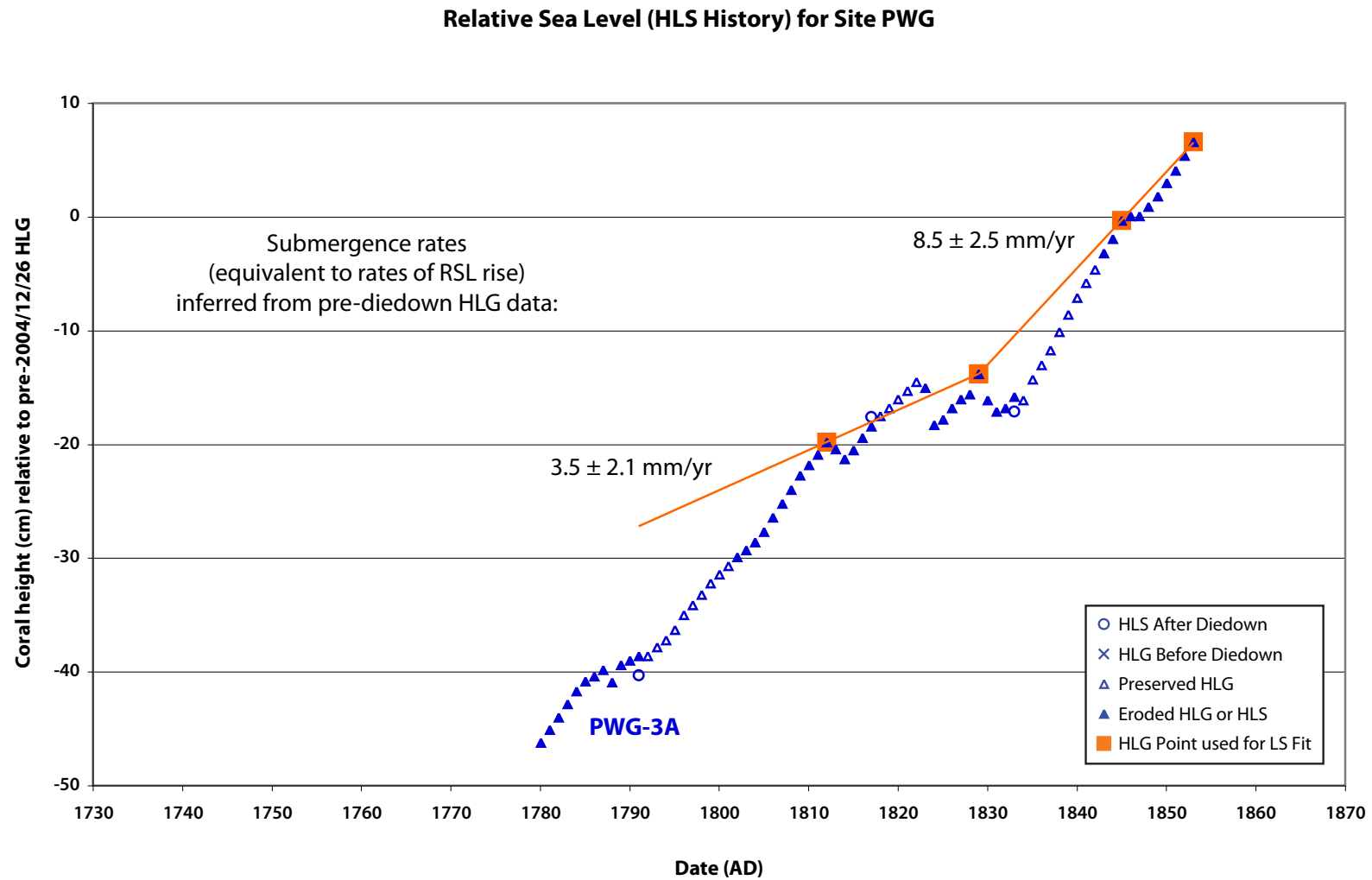


Figure S51. Relative sea level history derived from slab PWG-3A.

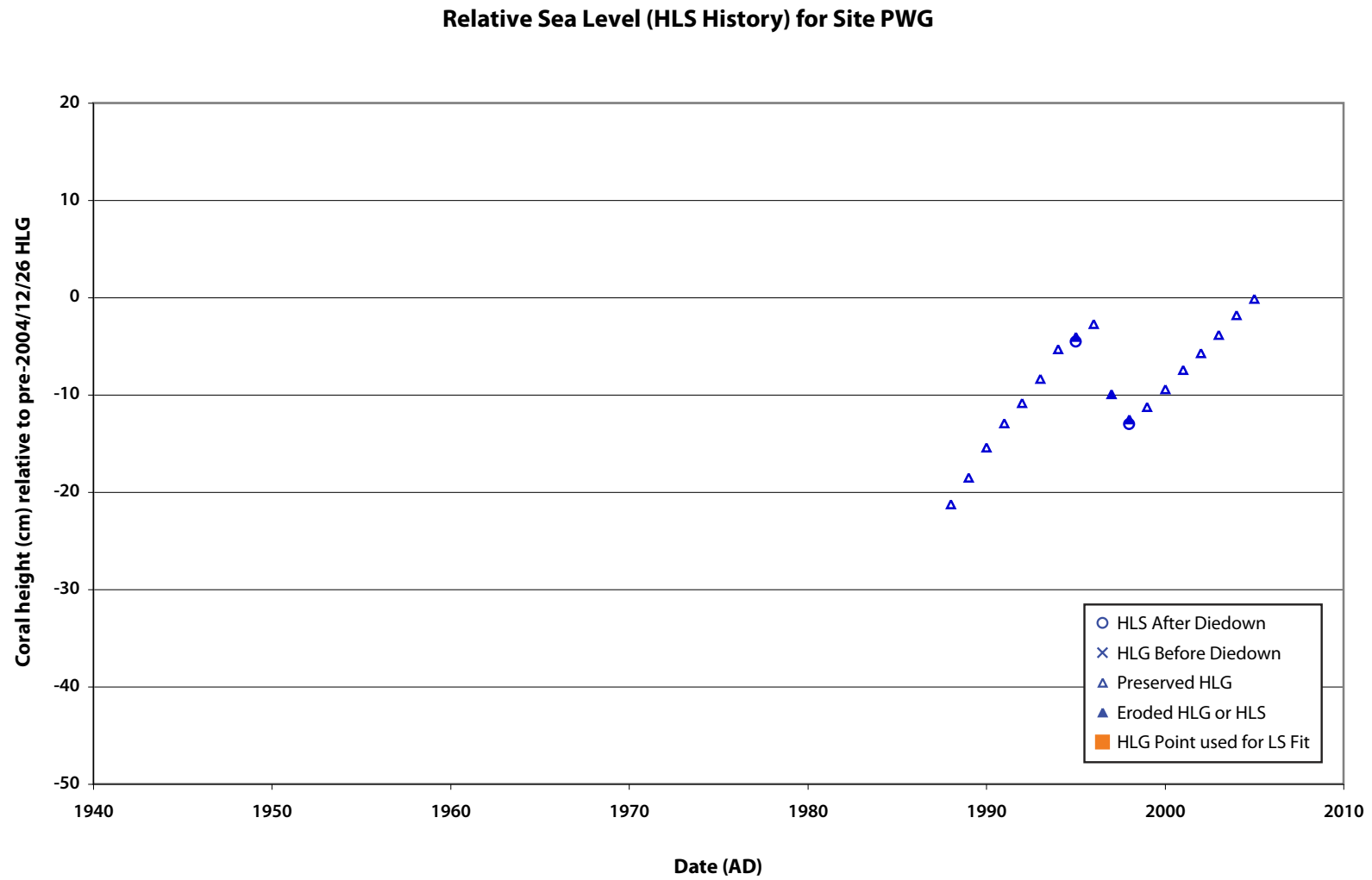


Figure S52. Relative sea level history derived from slab PWG-1.

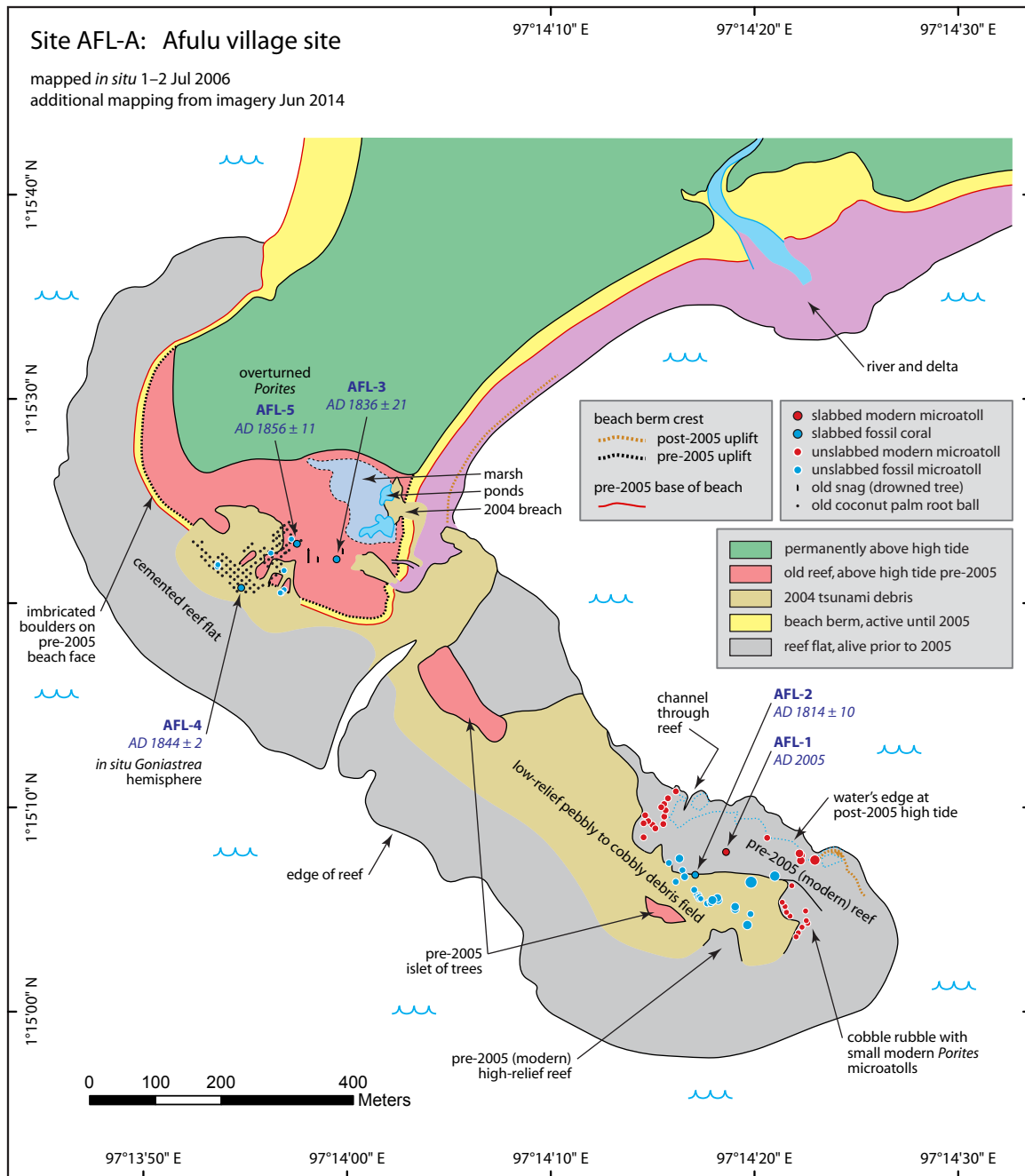


Figure S53. Map of site AFL-A, northern west coast of Nias, showing sampled corals and the date of each coral's outer band.

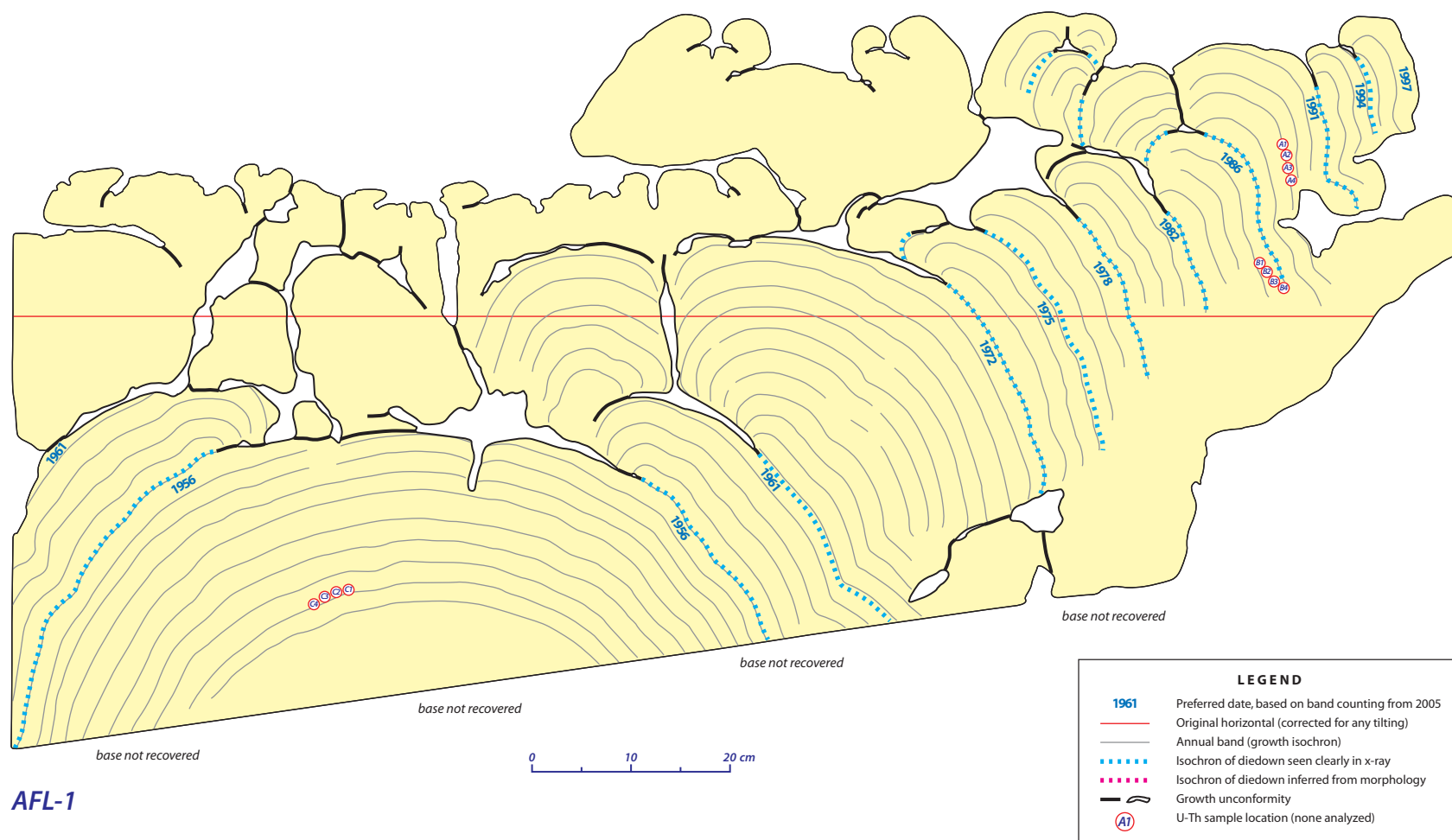


Figure S54. Cross-section of slab AFL-1, from site AFL-A.

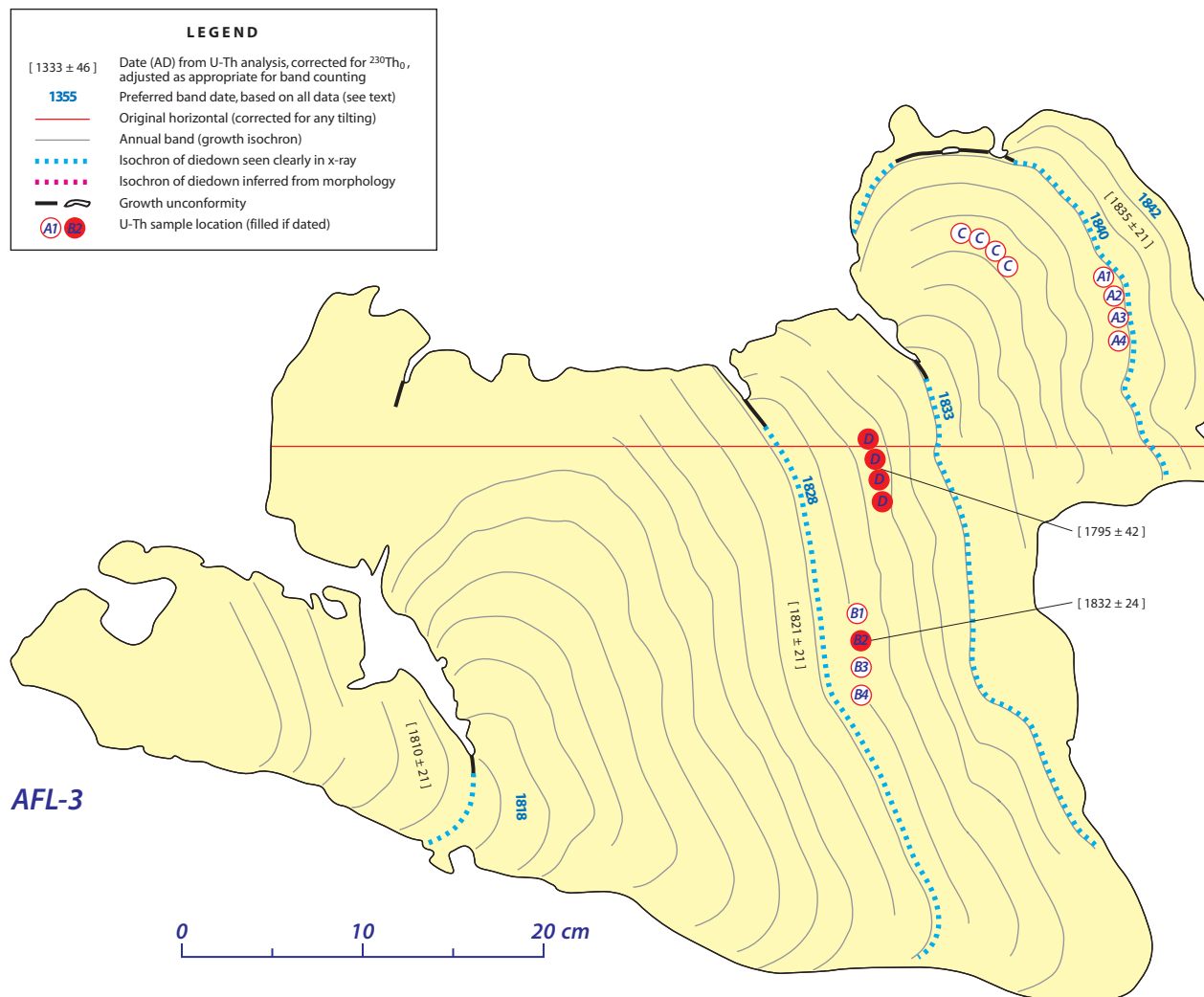


Figure S55. Cross-section of slab AFL-3, from site AFL-A.

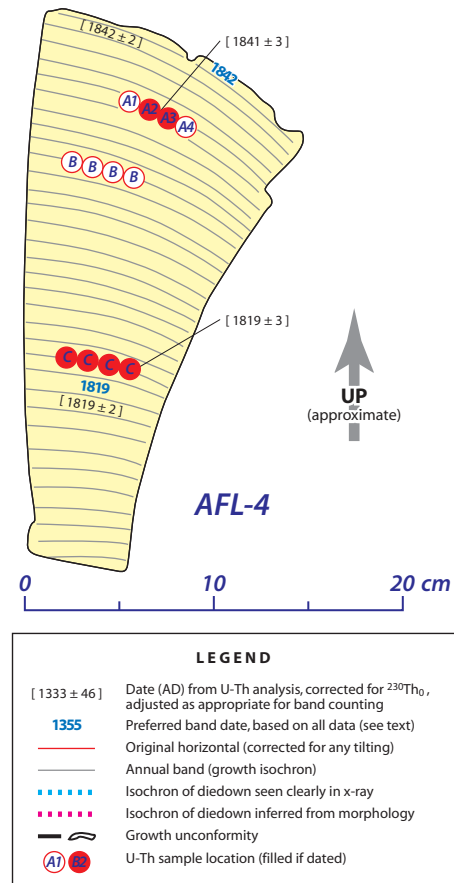


Figure S56. Cross-section of slab AFL-4, from site AFL-A.

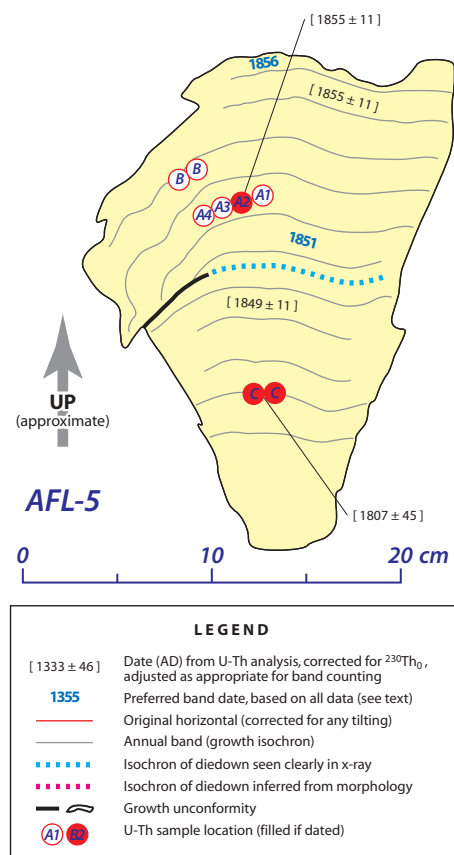


Figure S57. Cross-section of slab AFL-5, from site AFL-A.

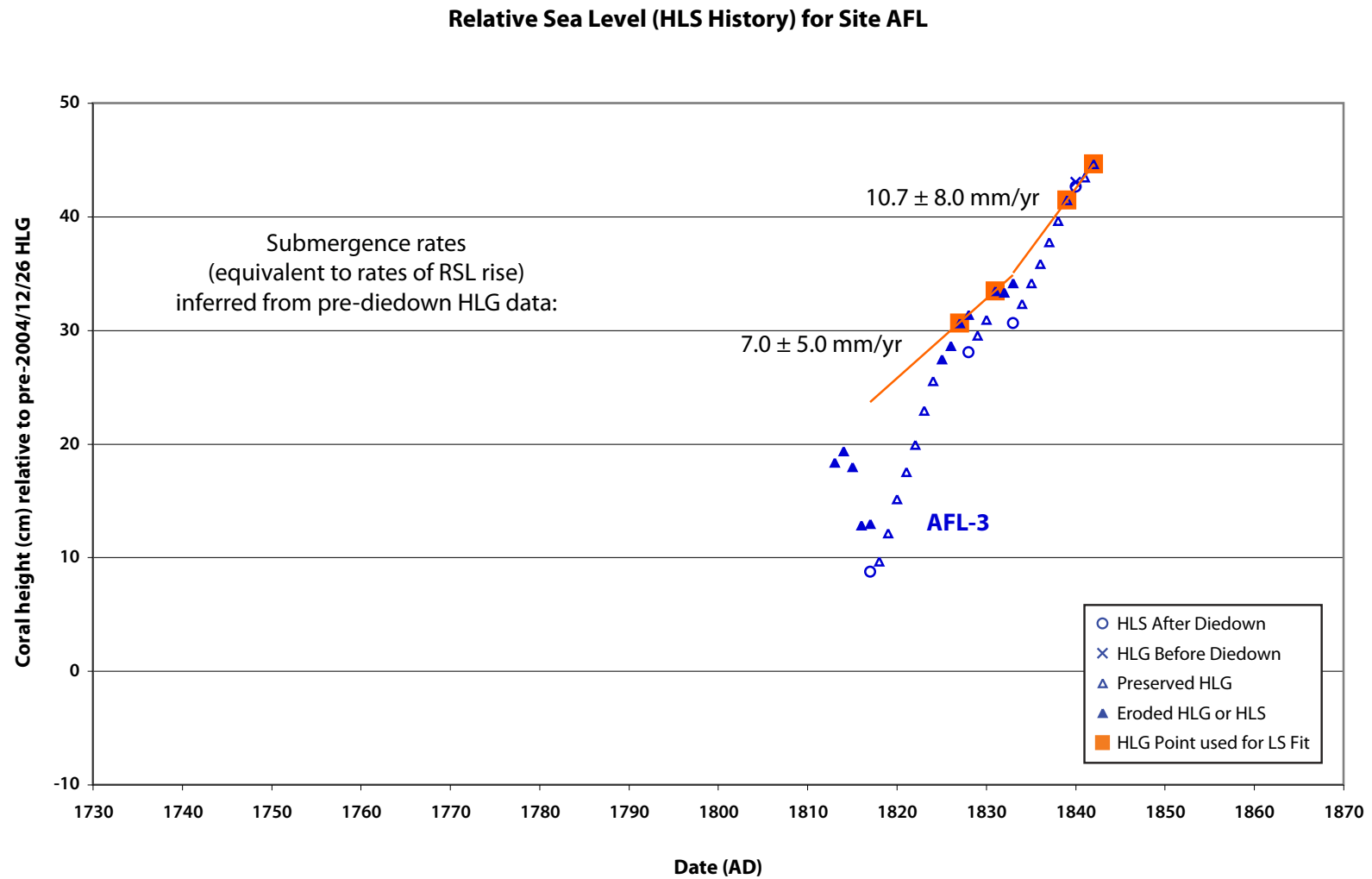


Figure S58. Relative sea level history derived from slab AFL-3.

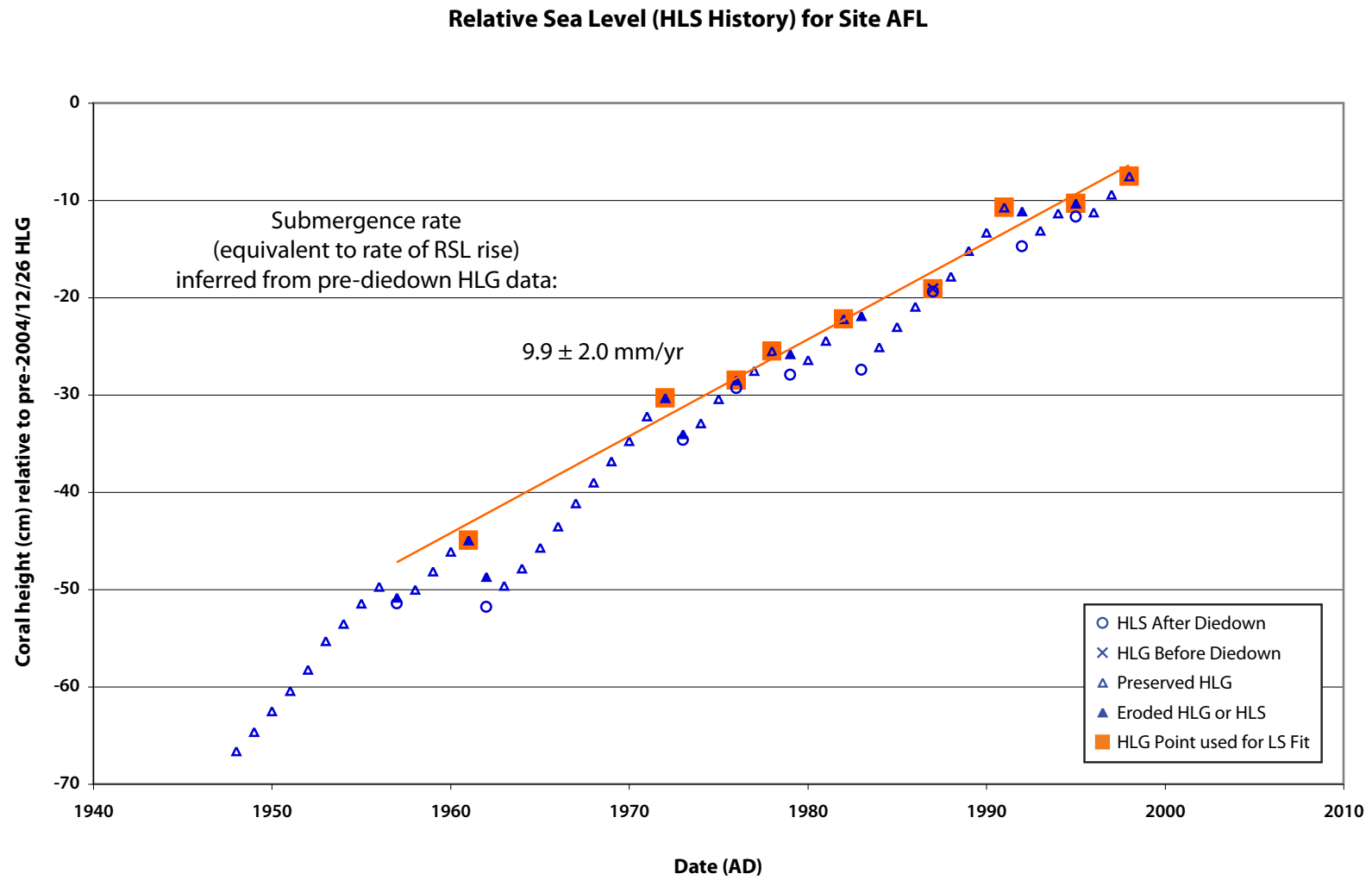


Figure S59. Relative sea level history derived from slab AFL-1.

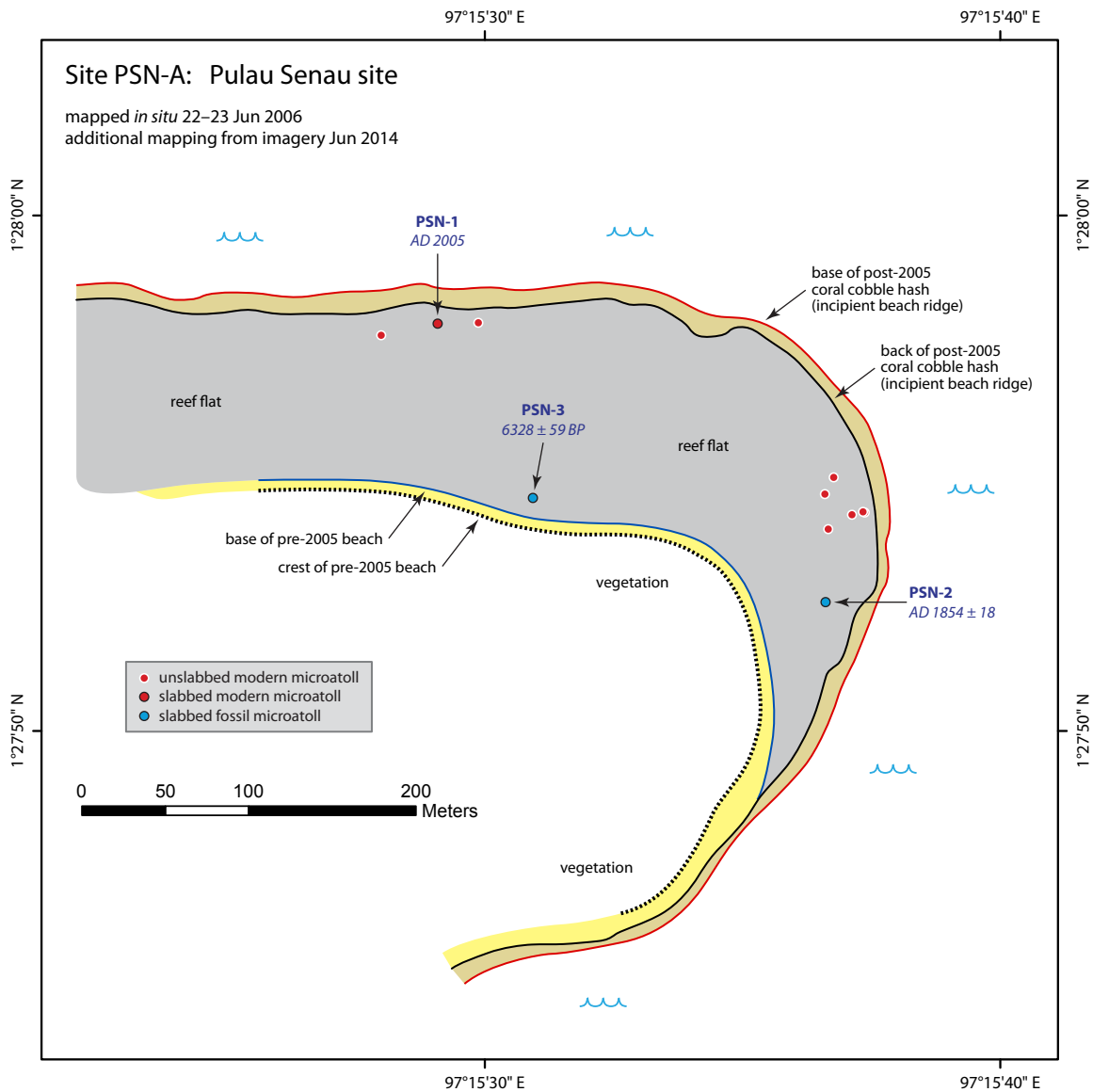


Figure S60. Map of site PSN-A, north coast of Nias, showing sampled microatolls and the date of each microatoll's outer band.

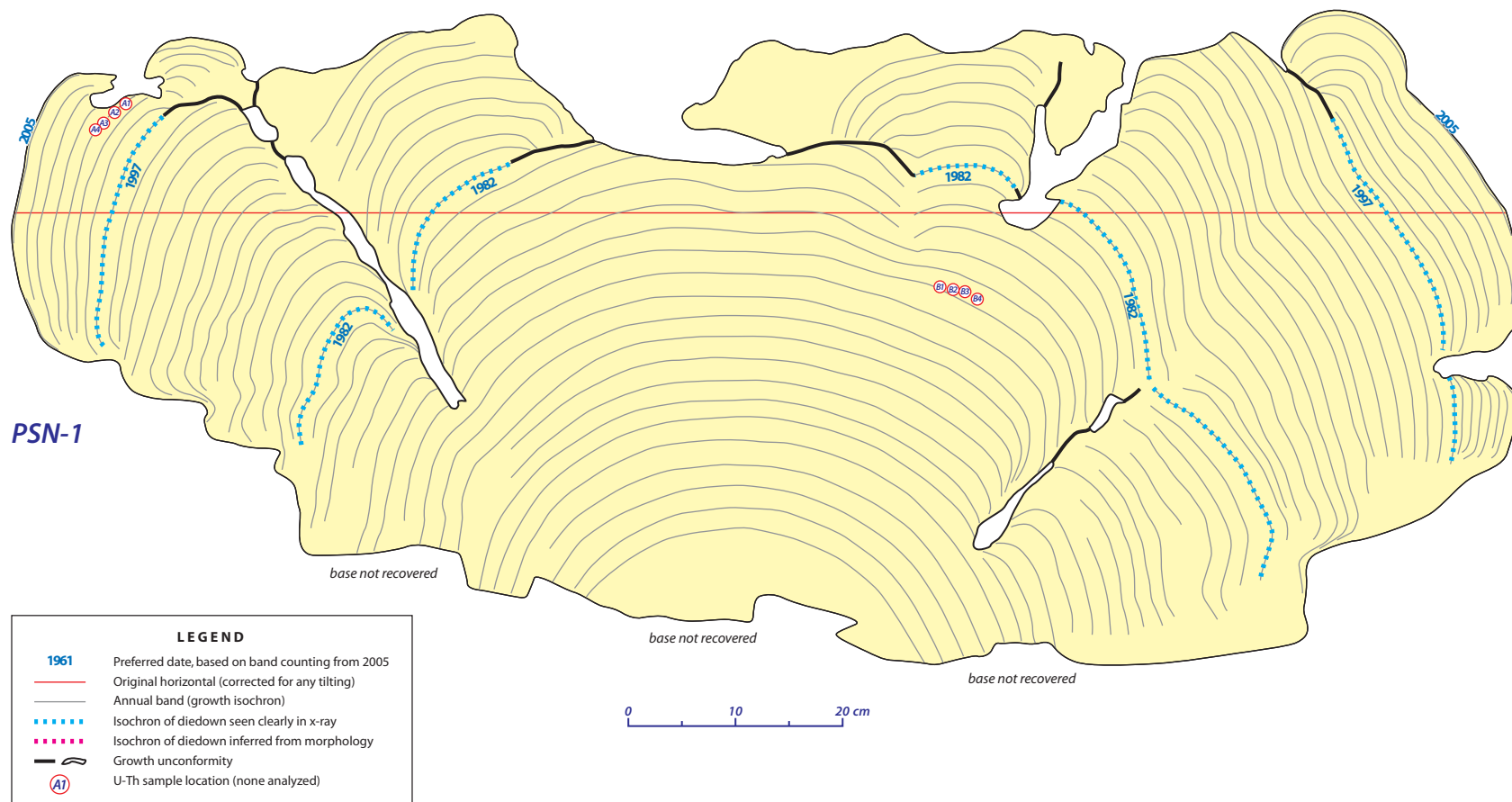


Figure S61. Cross-section of slab PSN-1, from site PSN-A.

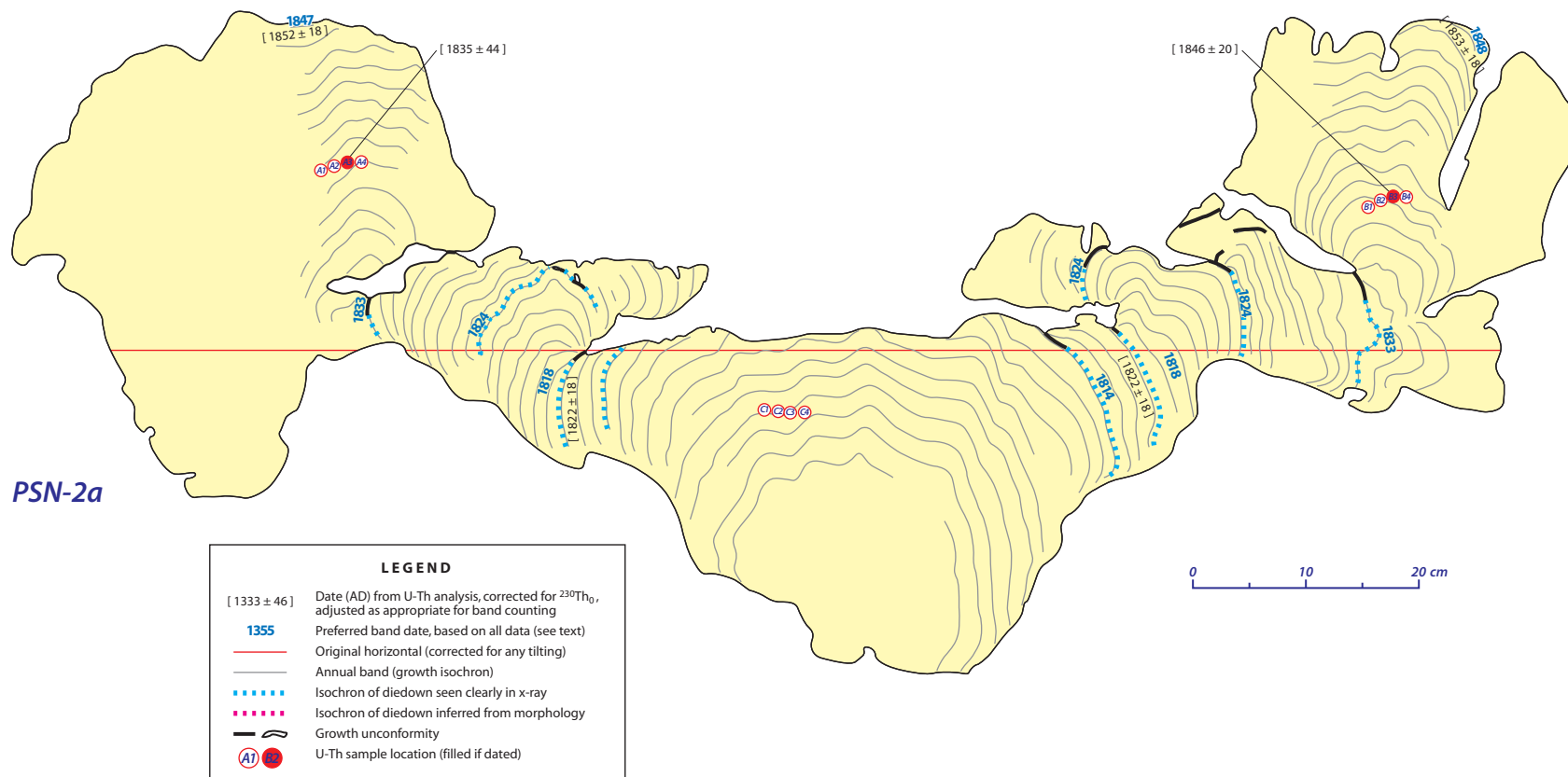


Figure S62. Cross-section of slab PSN-2 (slice a), from site PSN-A.

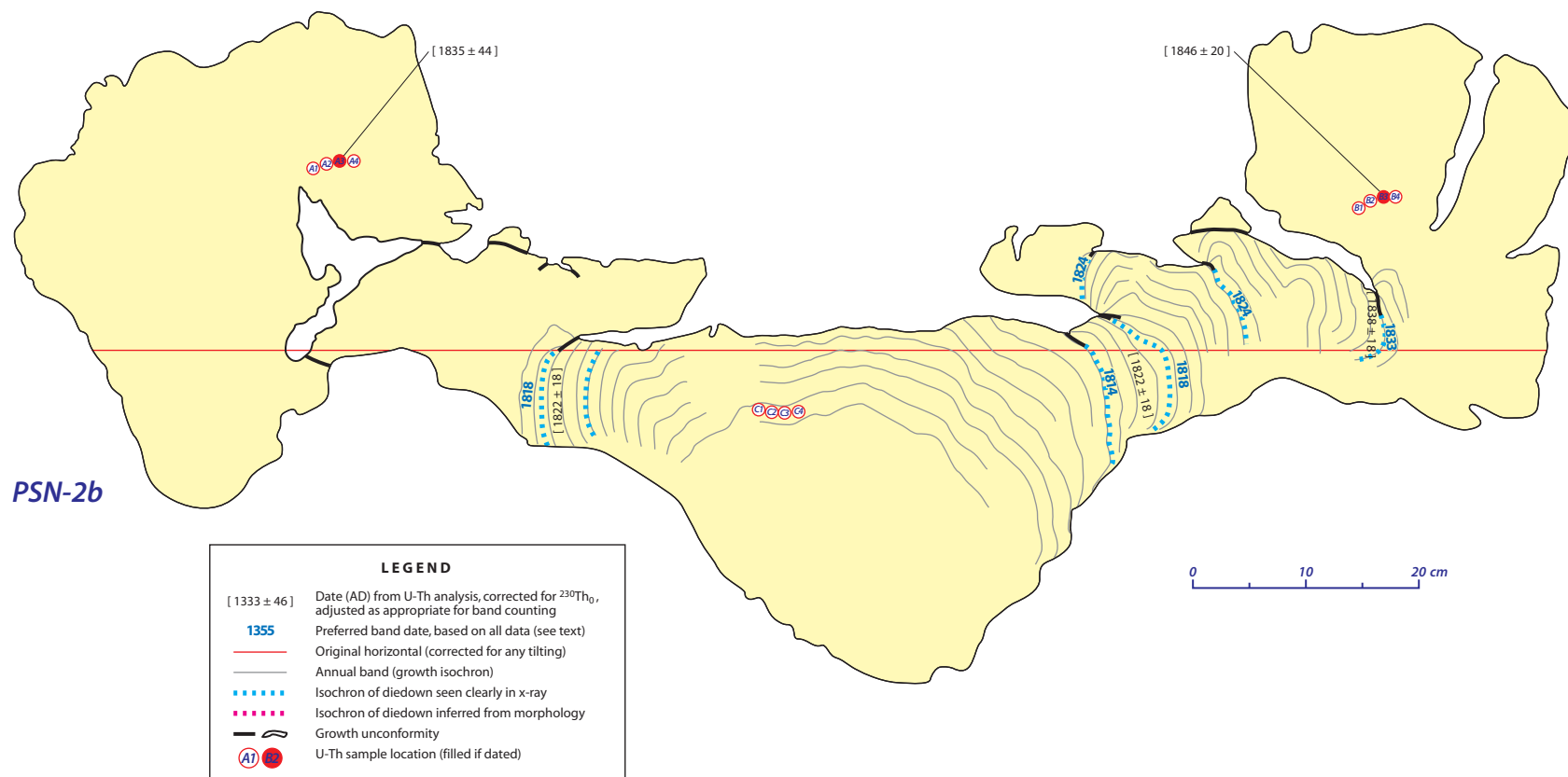


Figure S63. Cross-section of slab PSN-2 (slice b), from site PSN-A.

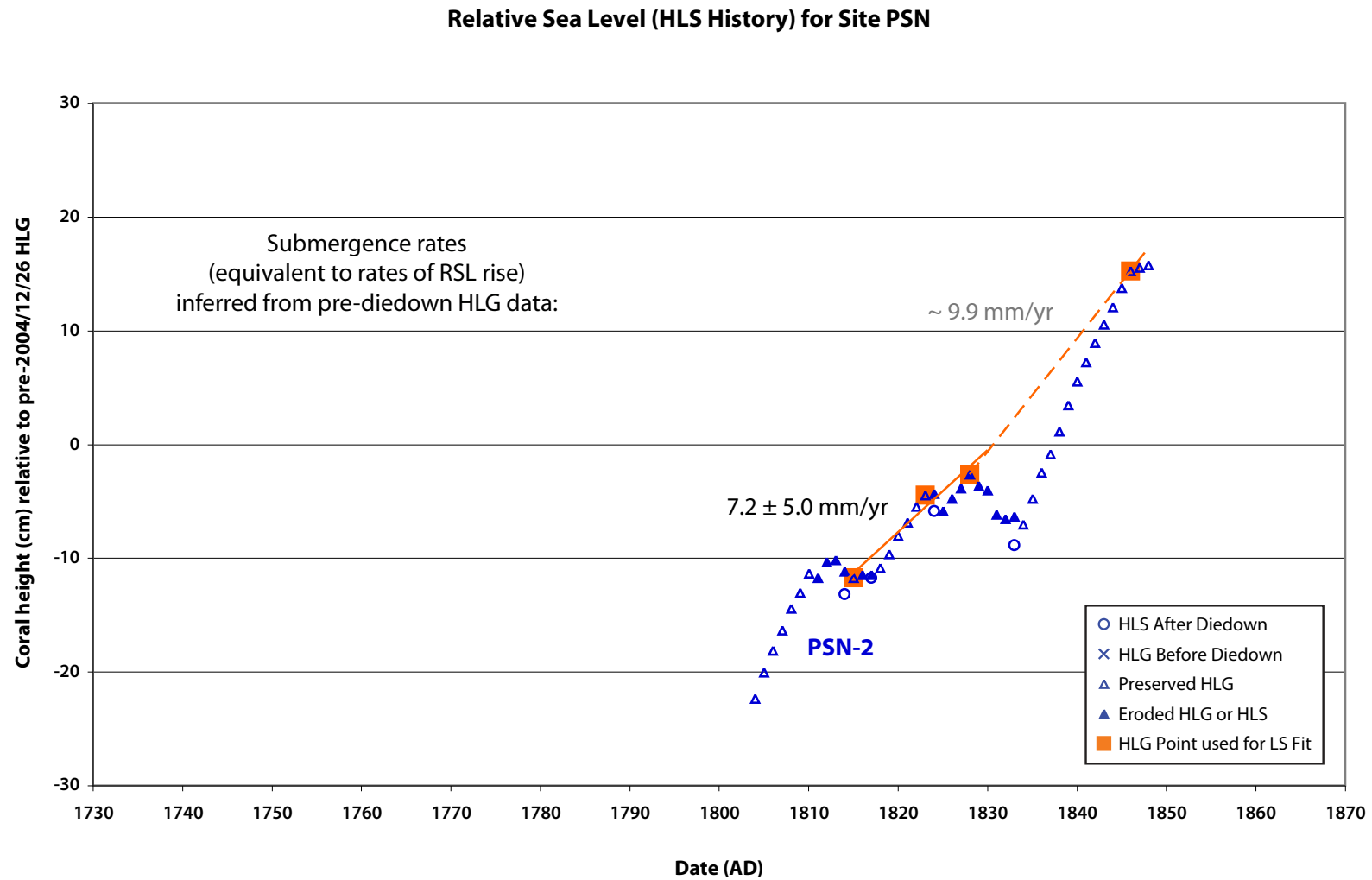


Figure S64. Relative sea level history derived from slab PSN-2.

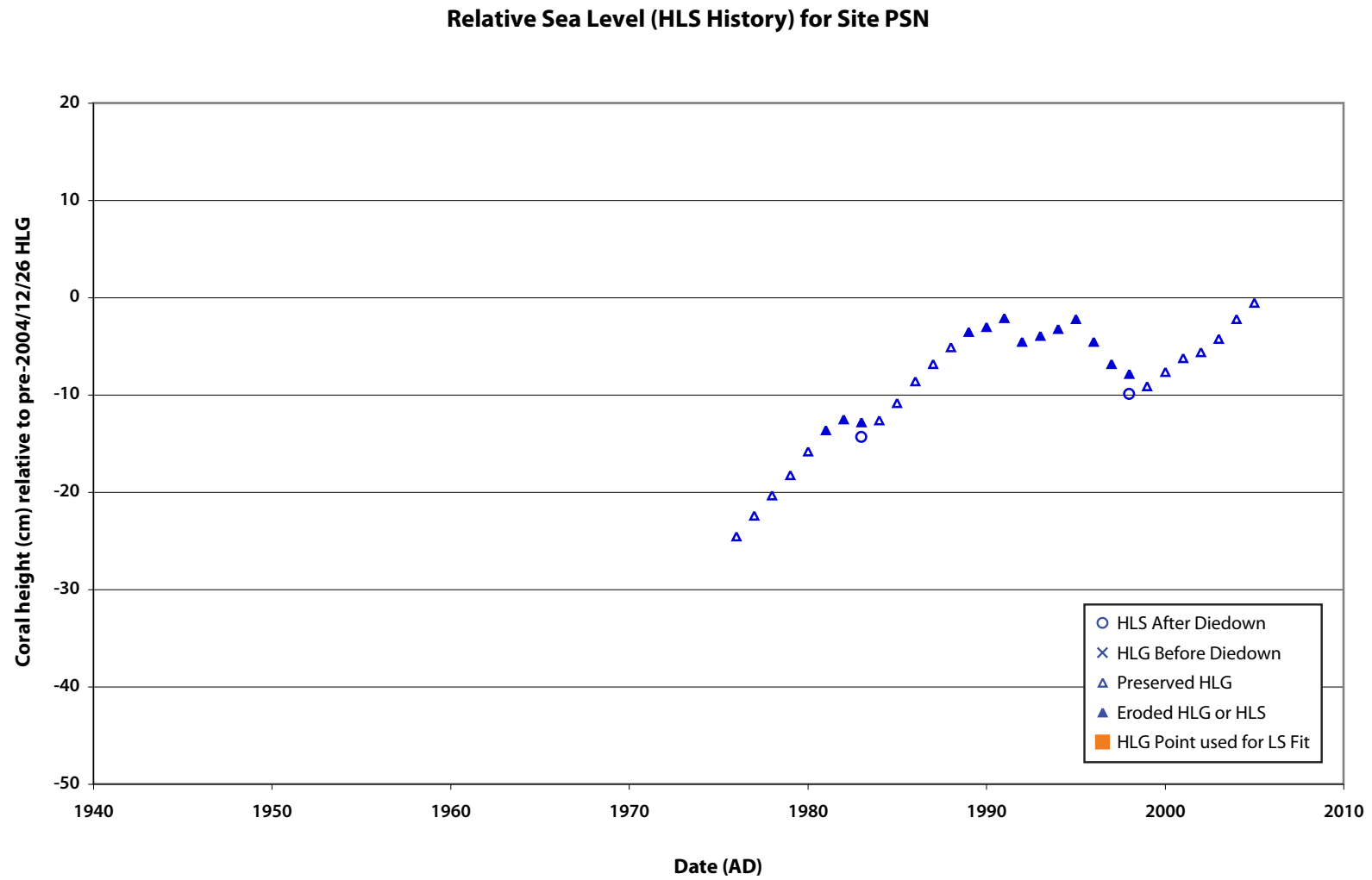


Figure S65. Relative sea level history derived from slab PSN-1.

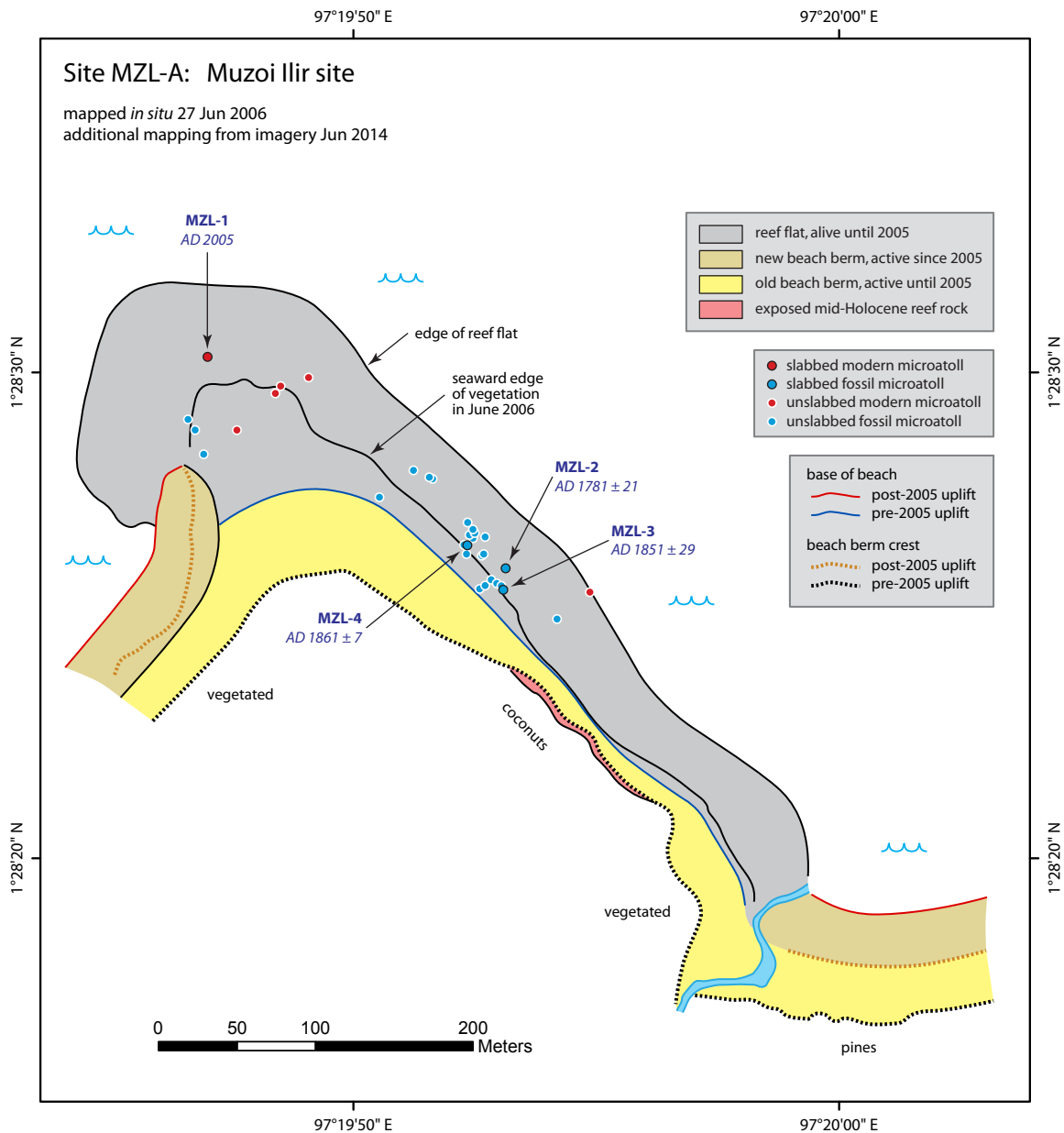


Figure S66. Map of site MZL-A, north coast of Nias, showing sampled microatolls and the date of each microatoll's outer band.

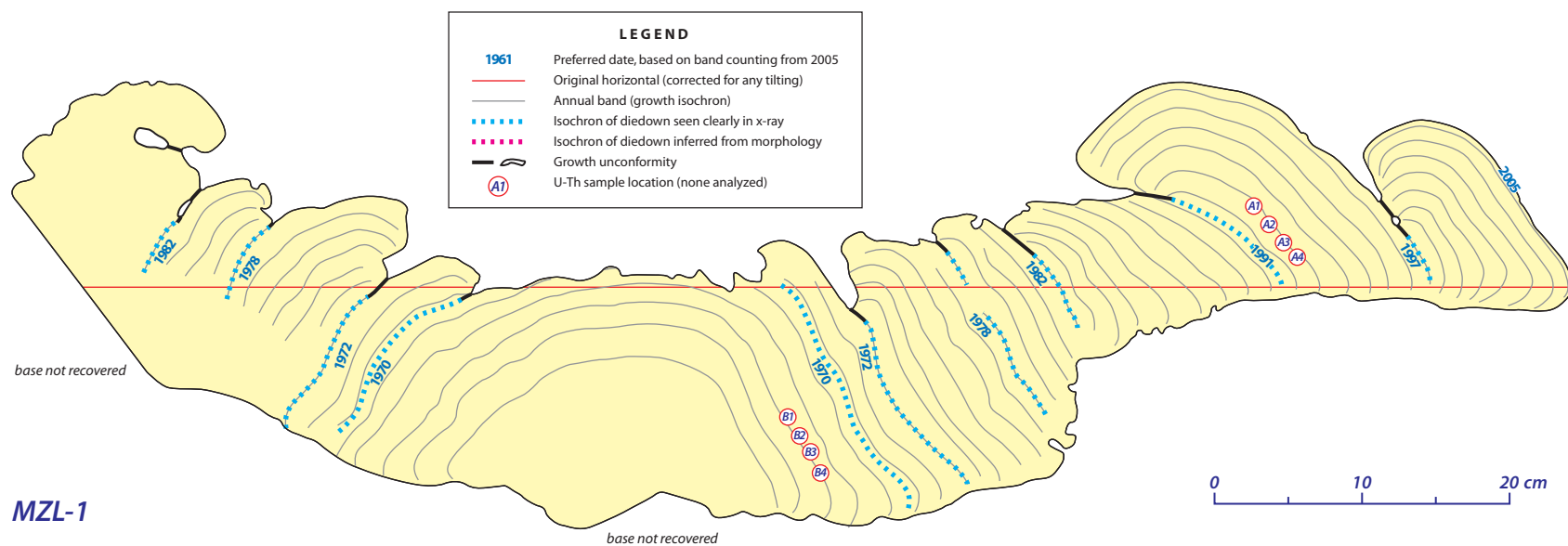


Figure S67. Cross-section of slab MZL-1, from site MZL-A.

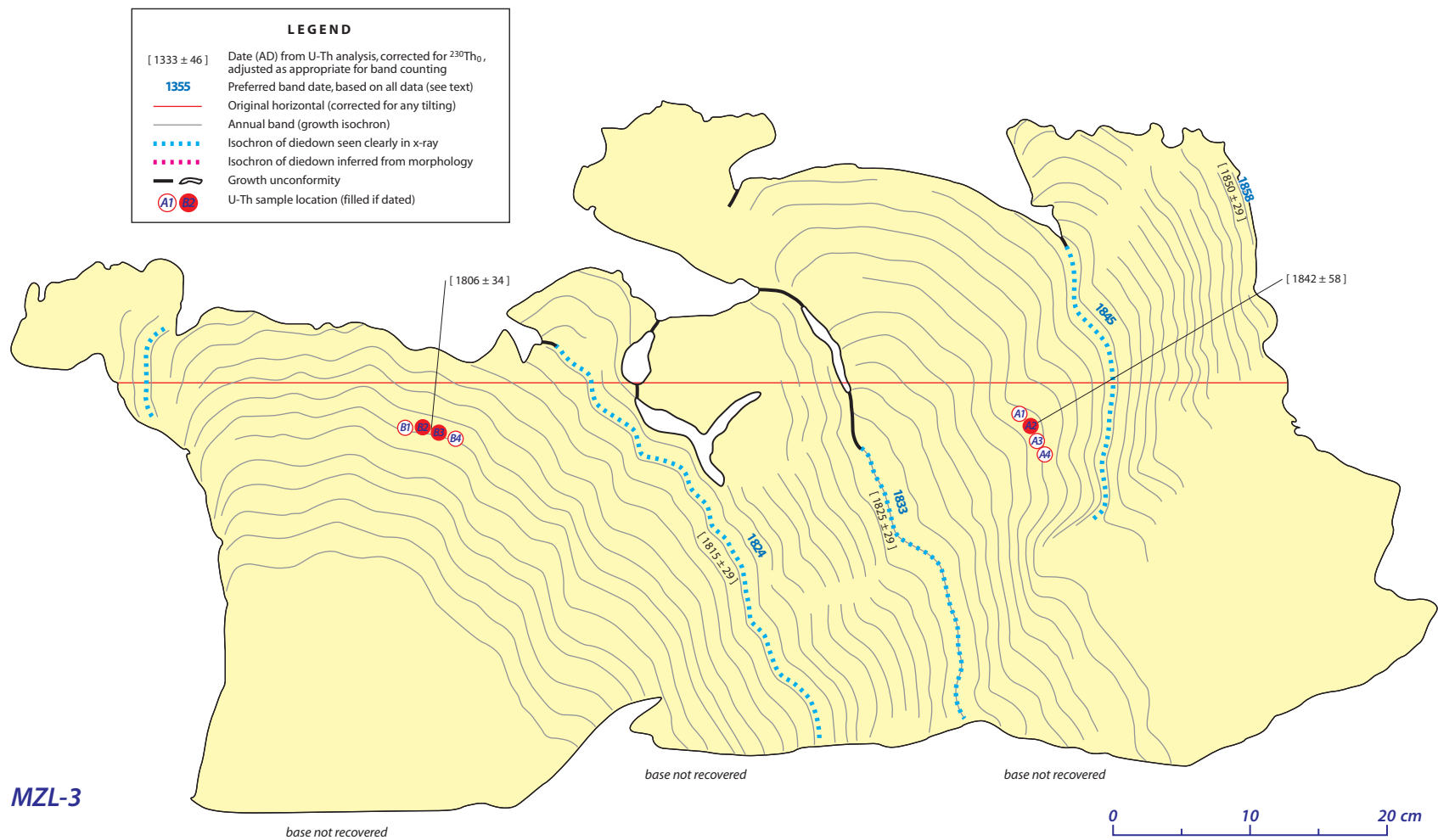


Figure S68. Cross-section of slab MZL-3, from site MZL-A.

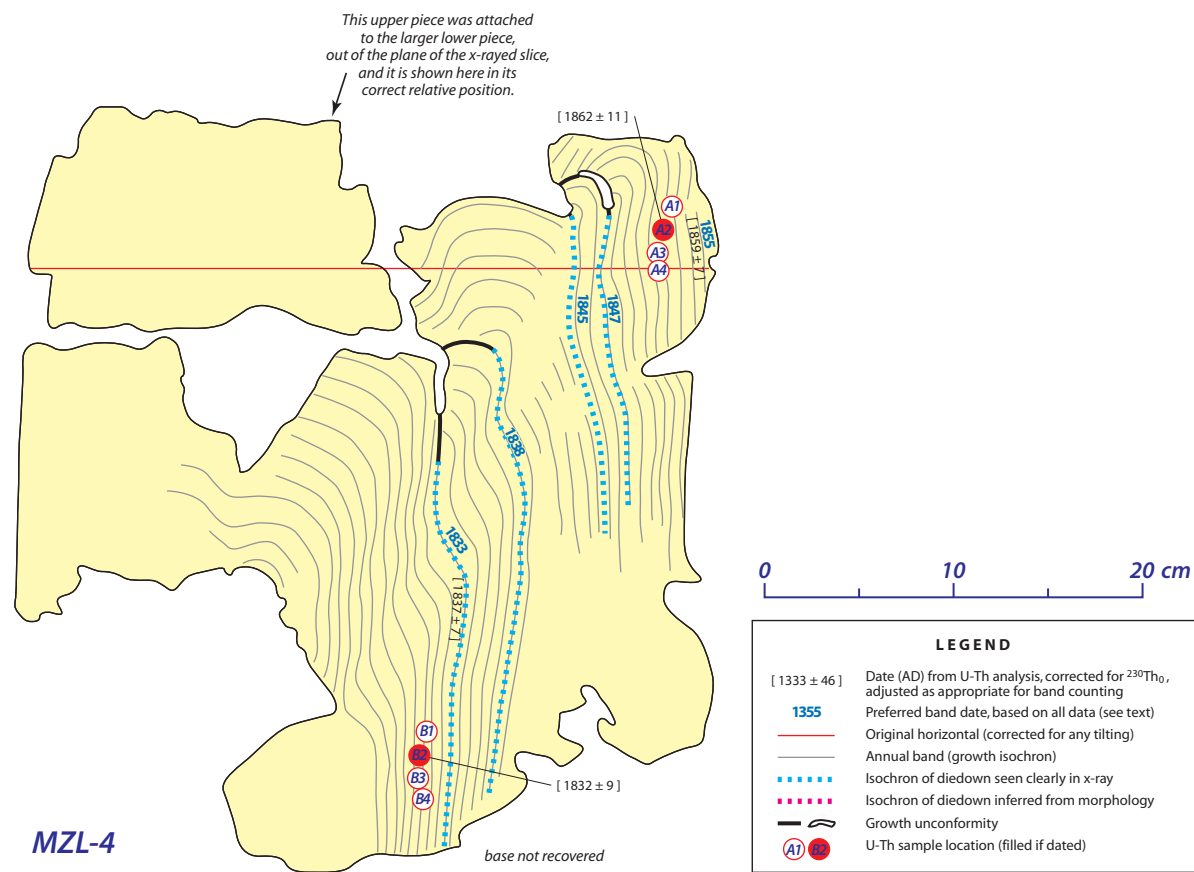


Figure S69. Cross-section of slab MZL-4, from site MZL-A.

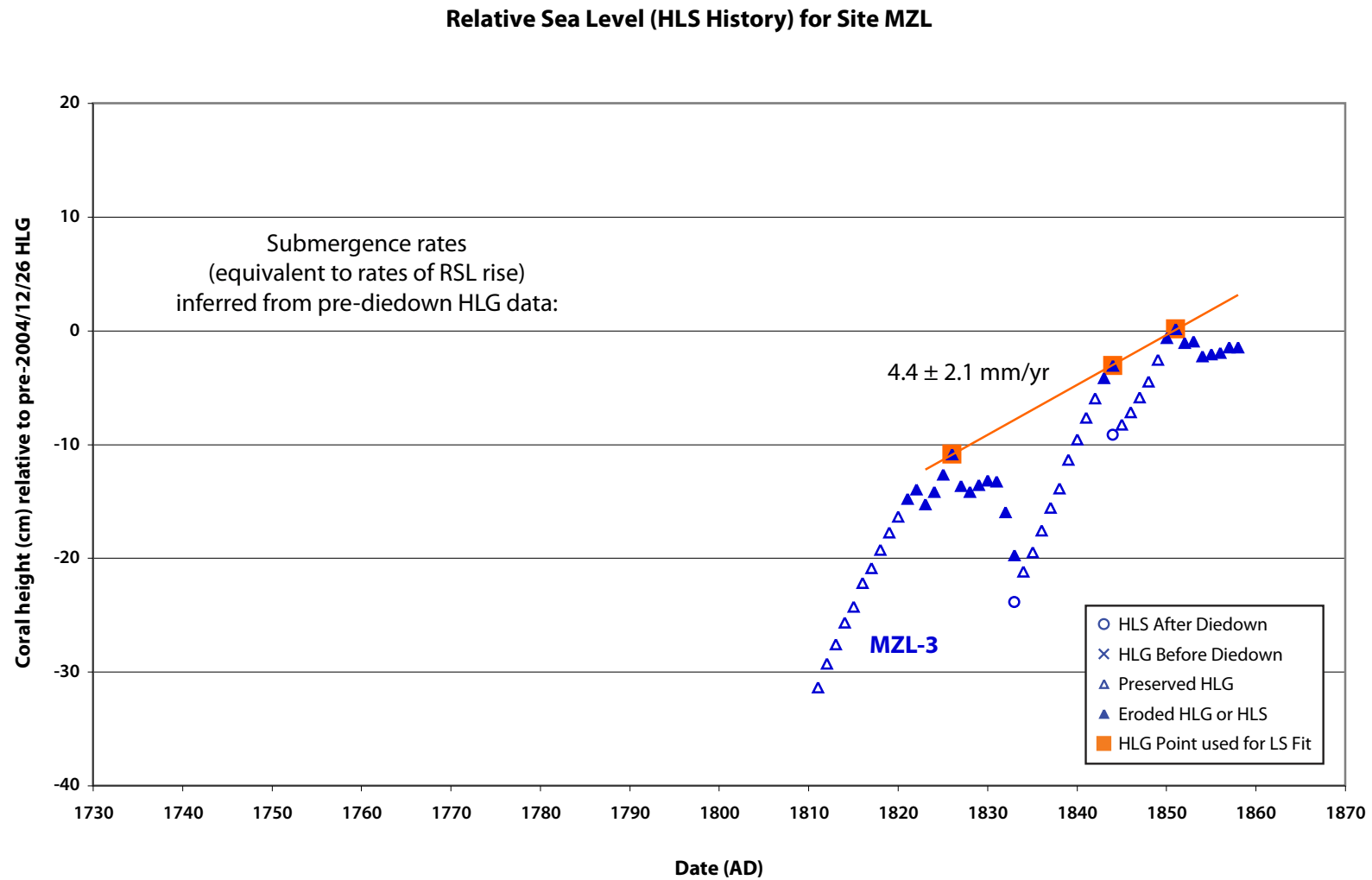


Figure S70. Relative sea level history derived from slab MZL-3.

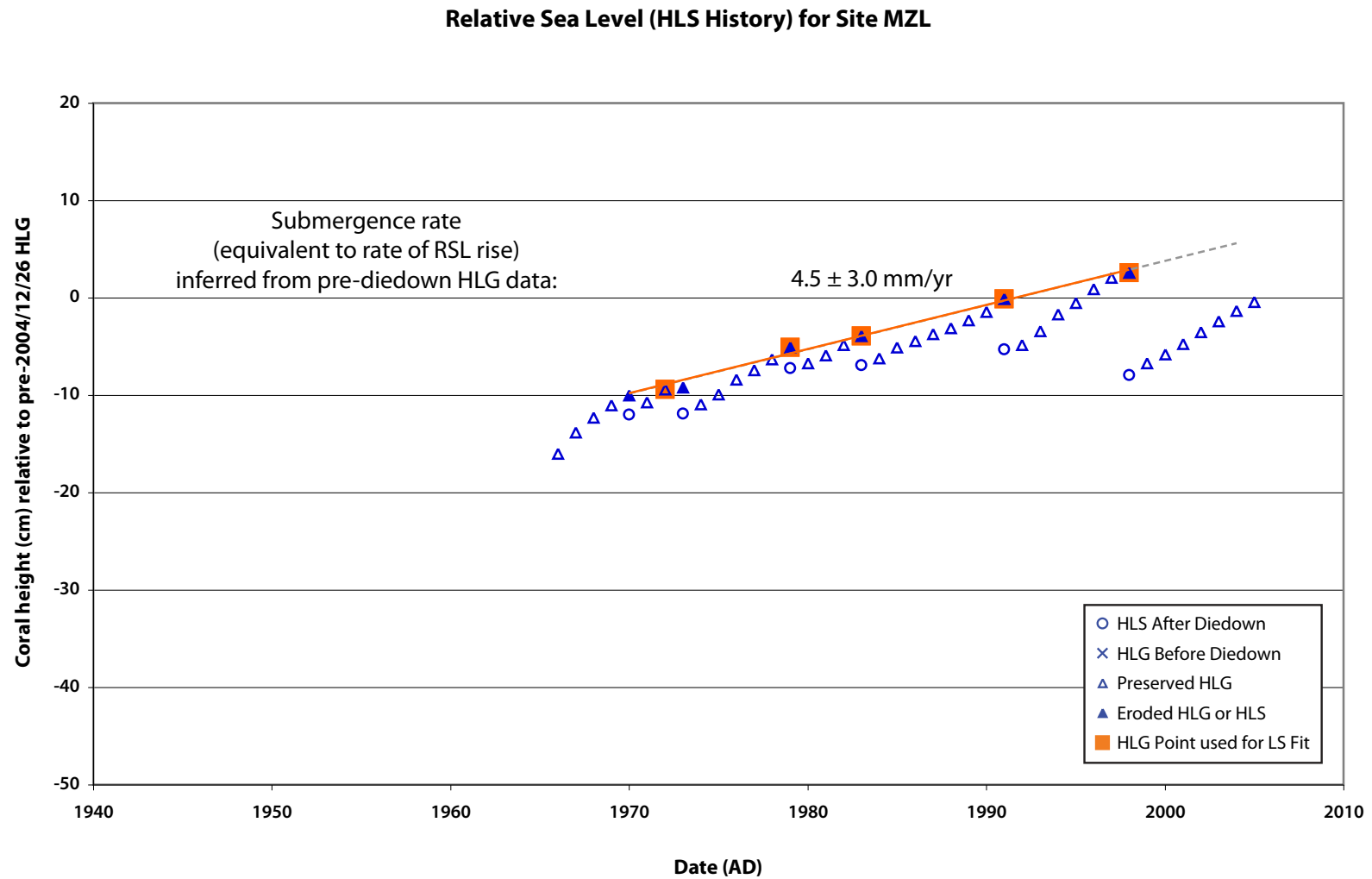


Figure S71. Relative sea level history derived from slab MZL-1.

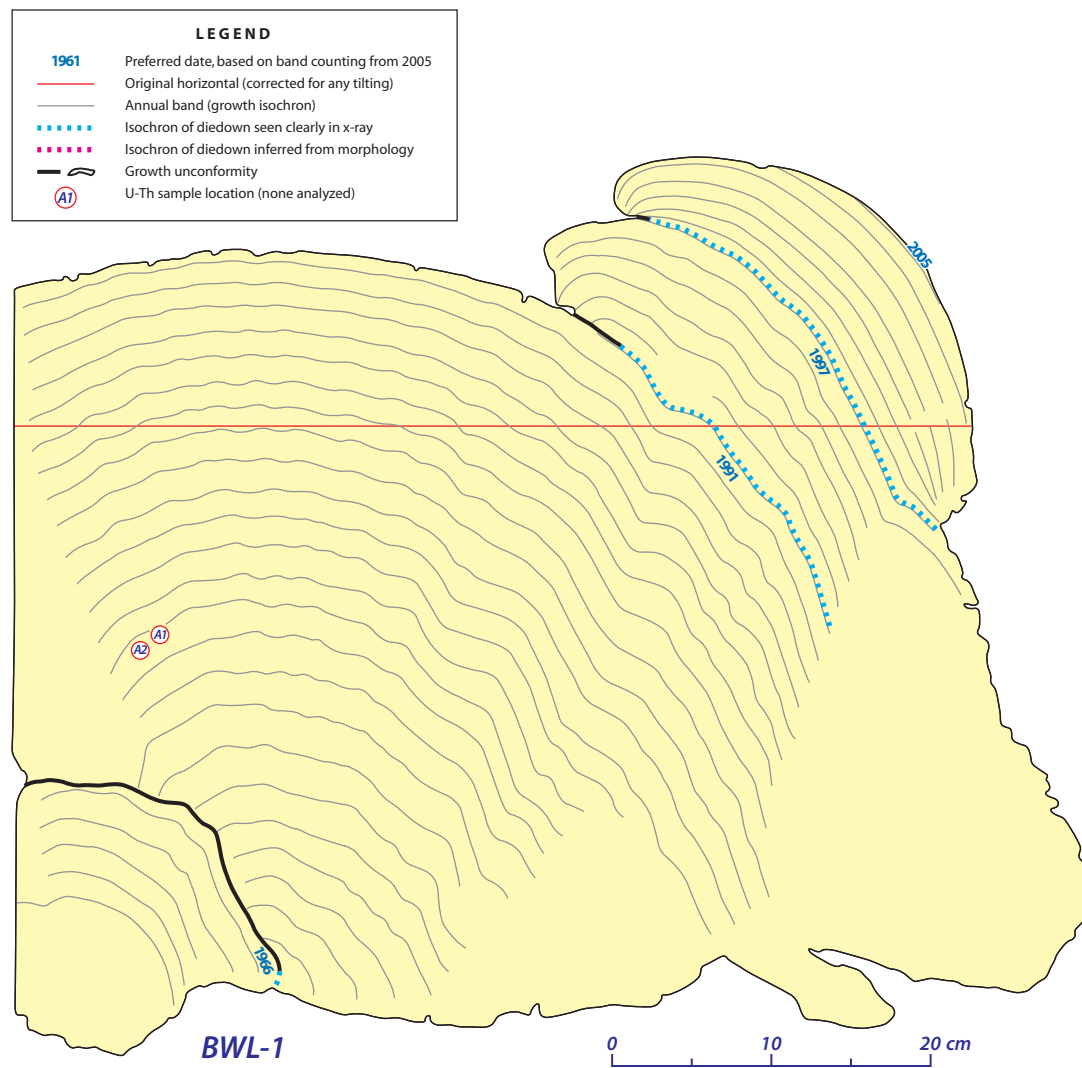


Figure S72. Cross-section of slab BWL-1, from site BWL-A.

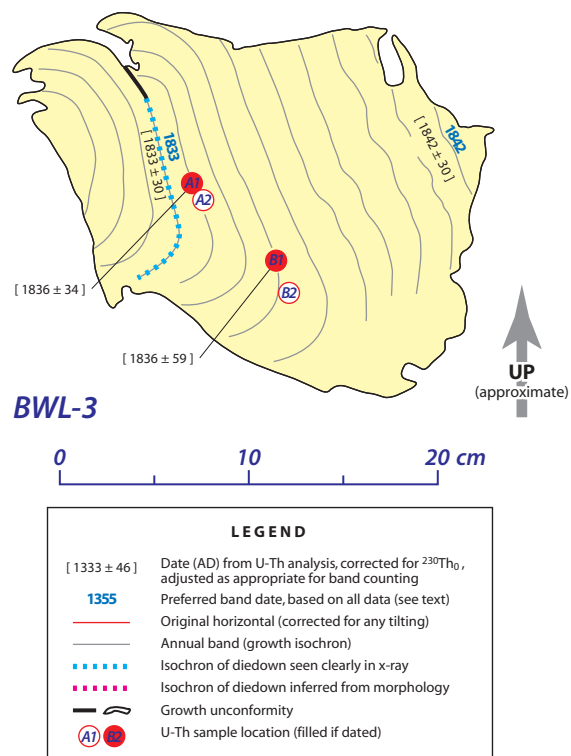


Figure S73. Cross-section of slab BWL-3, from site BWL-A.

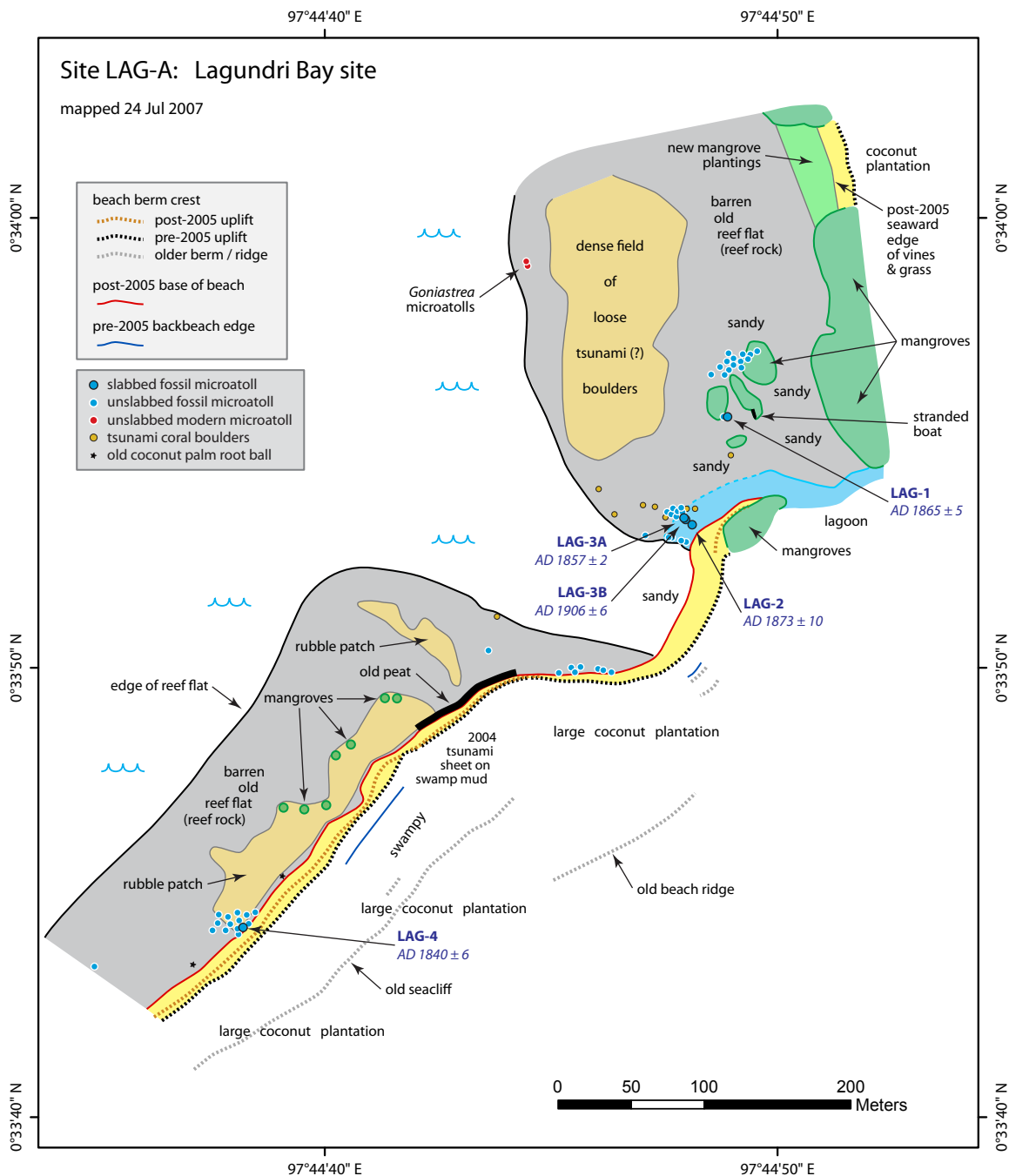


Figure S74. Map of site LAG-A, southwestern Nias, showing sampled microatolls and the date of each microatoll's outer band.

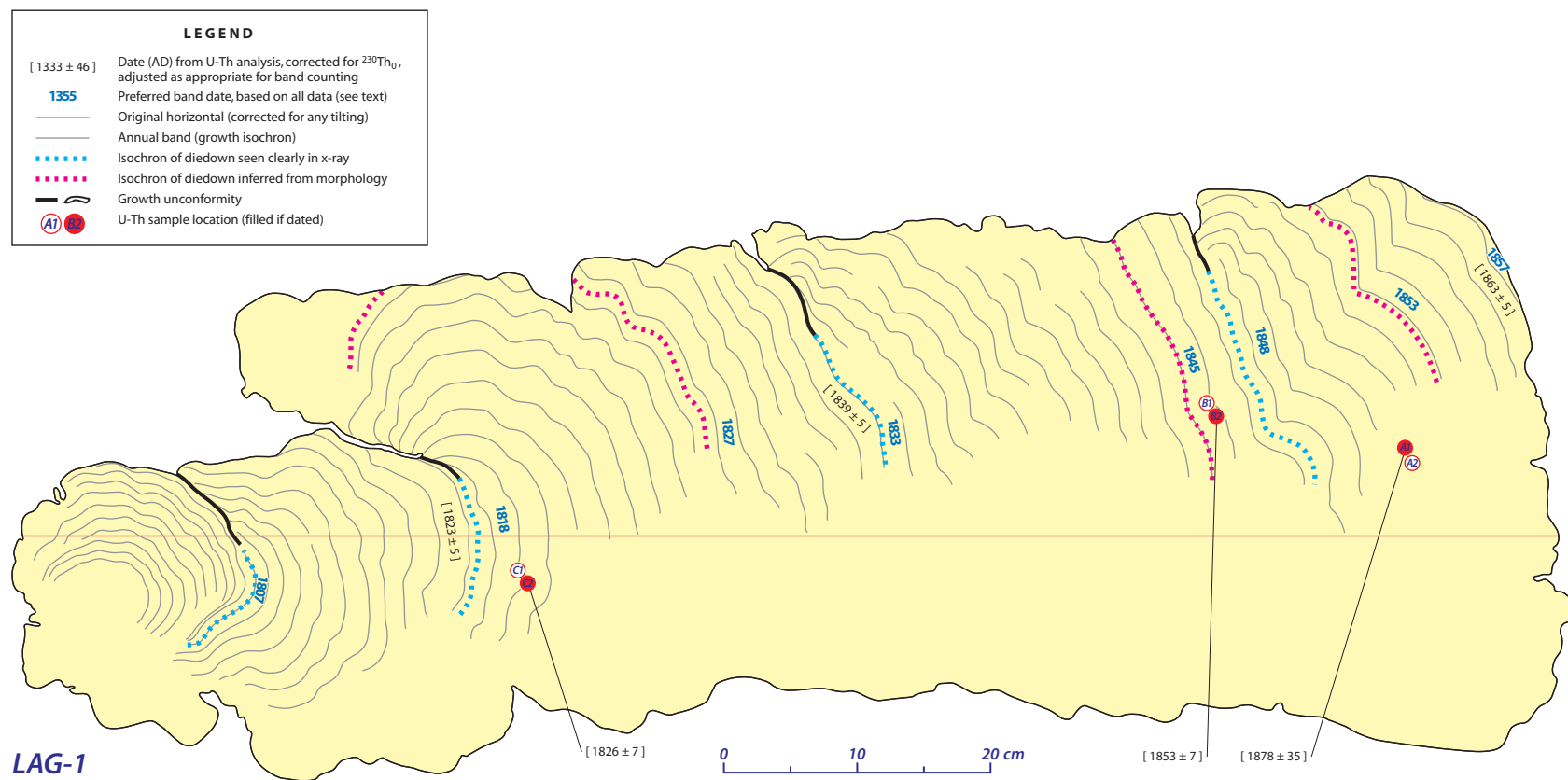


Figure S75. Cross-section of slab LAG-1, from site LAG-A.

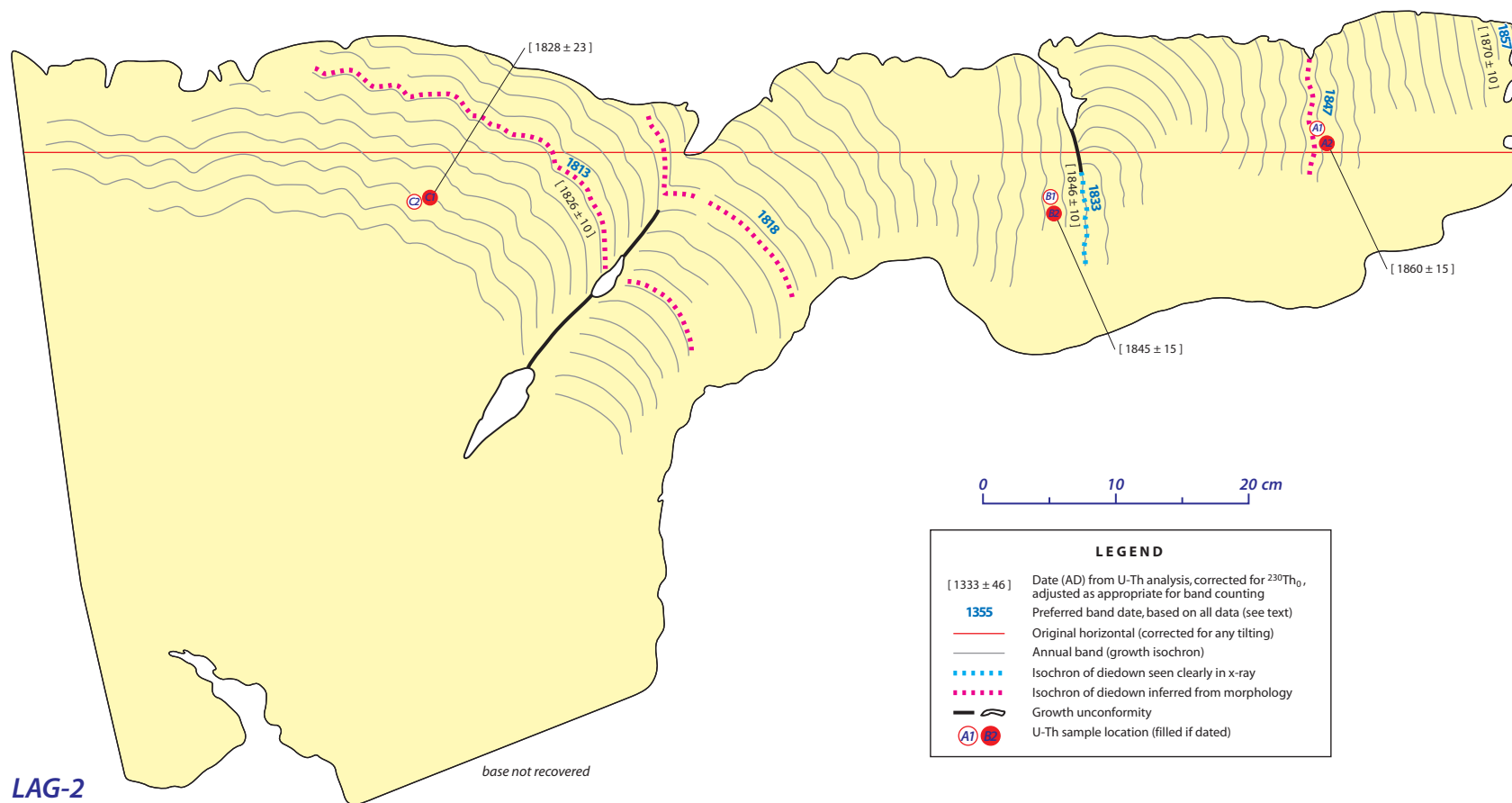


Figure S76. Cross-section of slab LAG-2, from site LAG-A.

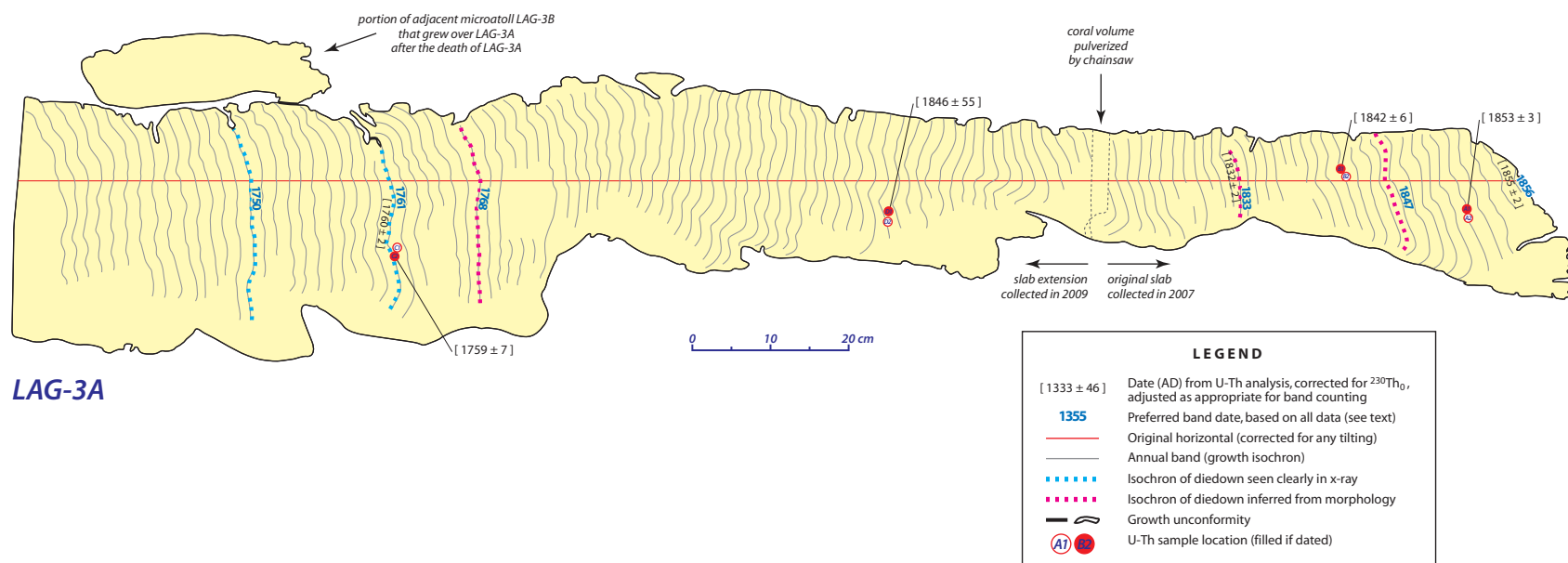


Figure S77. Cross-section of slab LAG-3A, from site LAG-A.

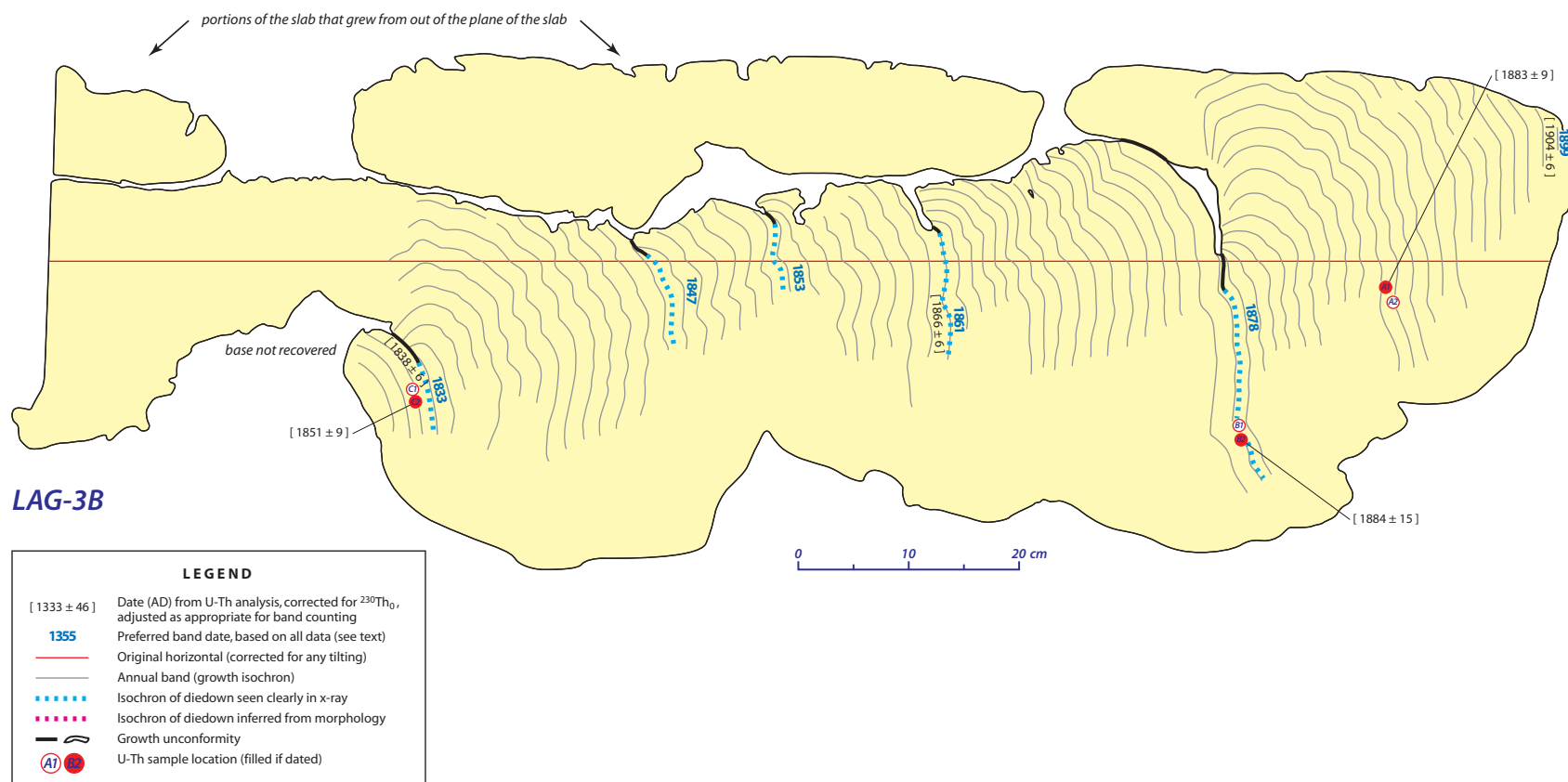
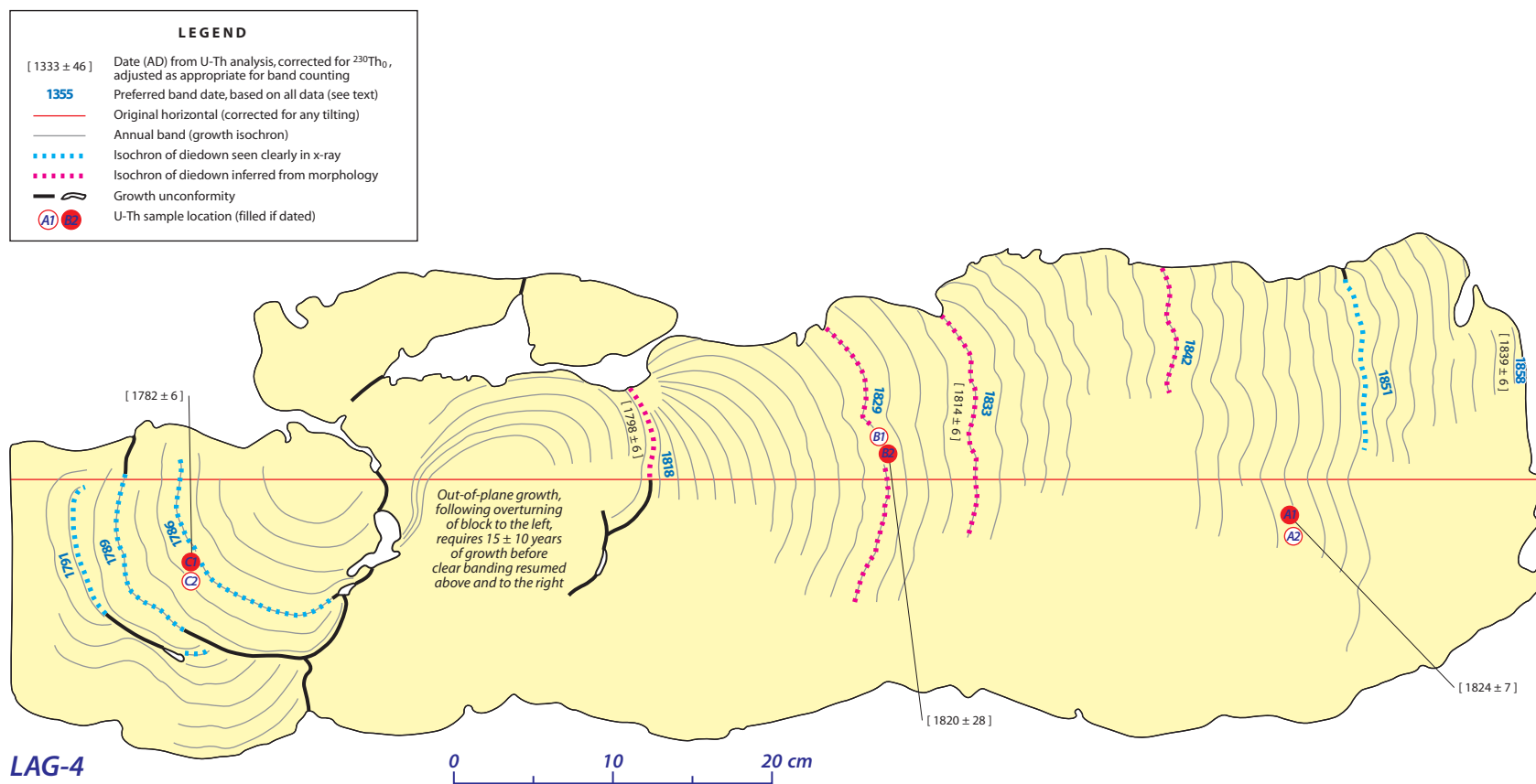


Figure S78. Cross-section of slab LAG-3B, from site LAG-A.



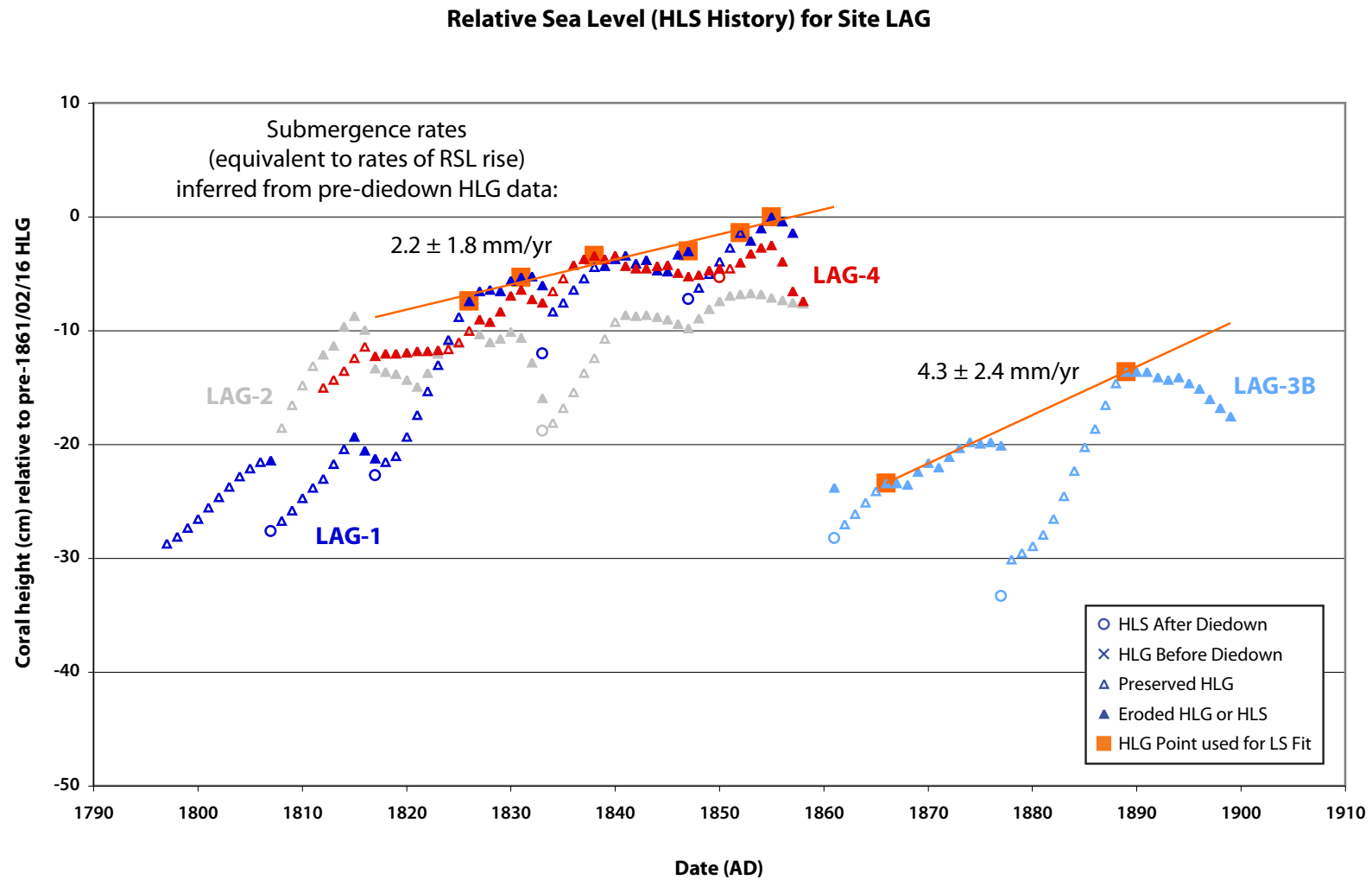


Figure S80. Relative sea level history derived from slabs LAG-1, LAG-2, LAG-3B, and LAG-4. Note that elevations are plotted relative to the HLG just before the 1861 earthquake, since the pre-2005 HLG at the site is unknown. Different colors represent data from different corals.

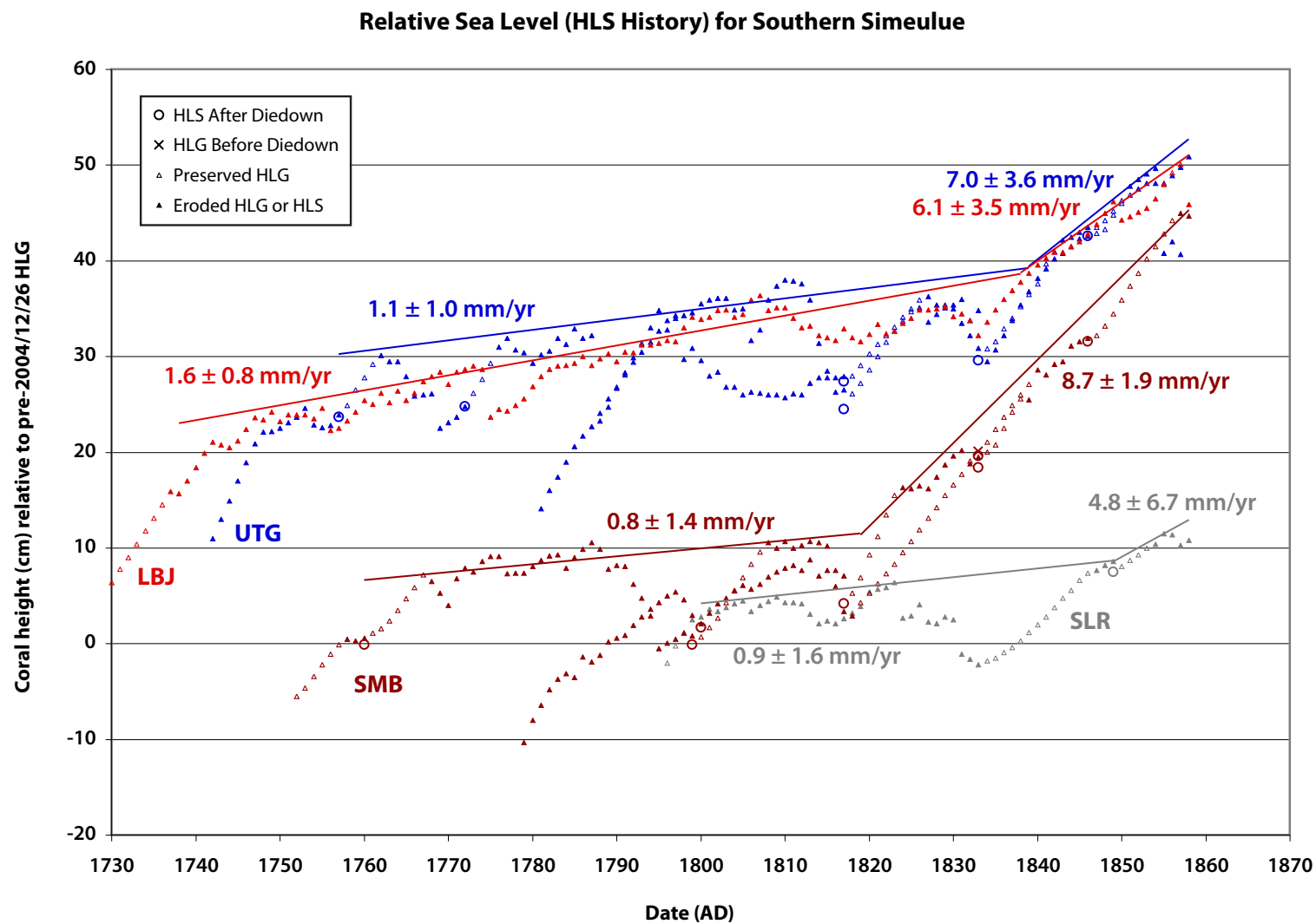


Figure S81. Relative sea level history for the 18th–19th centuries for Southern Simeulue. Different colors represent data from different sites.

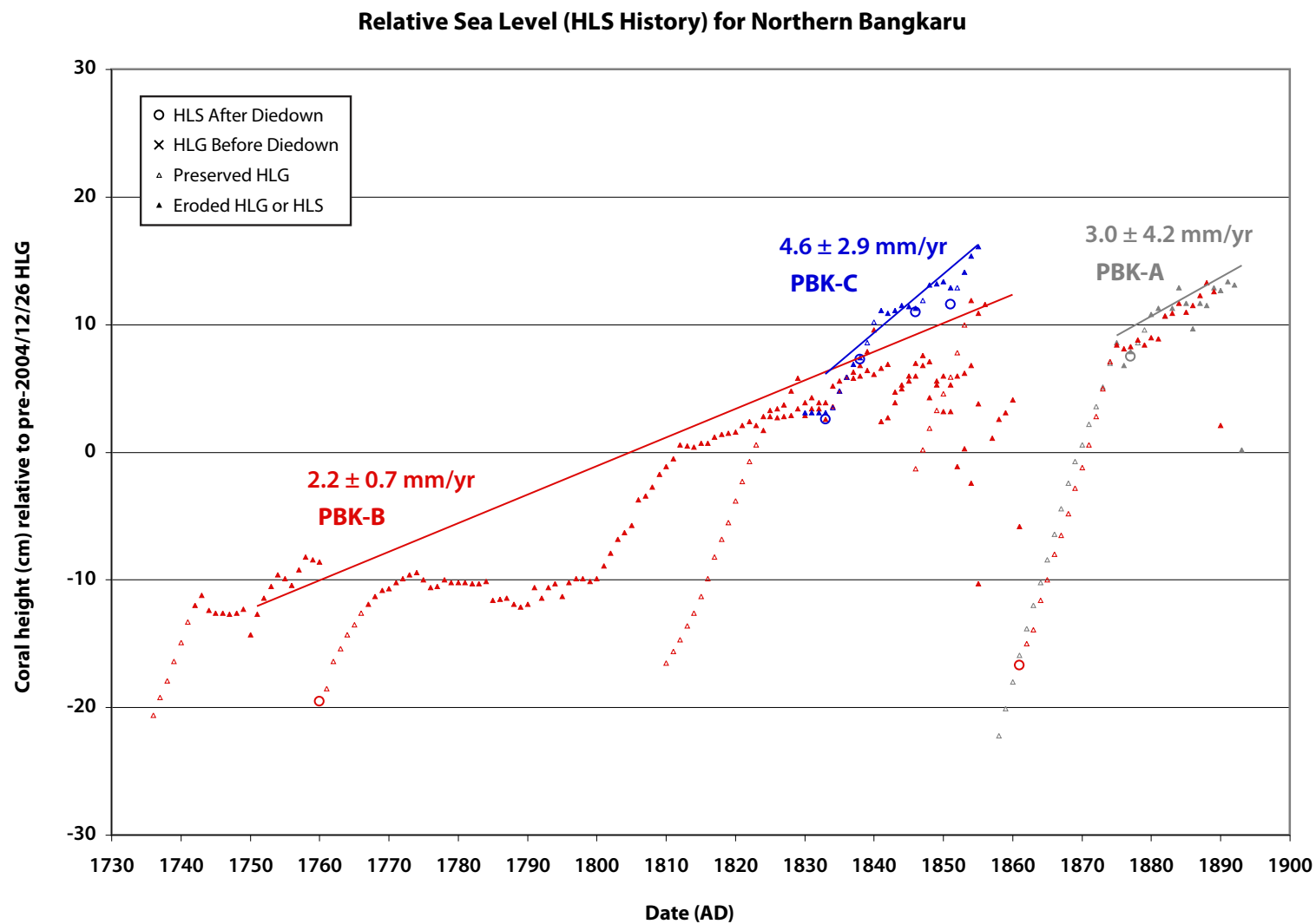


Figure S82. Relative sea level history for the 18th–19th centuries for Northern Bangkaru. Different colors represent data from different sites.

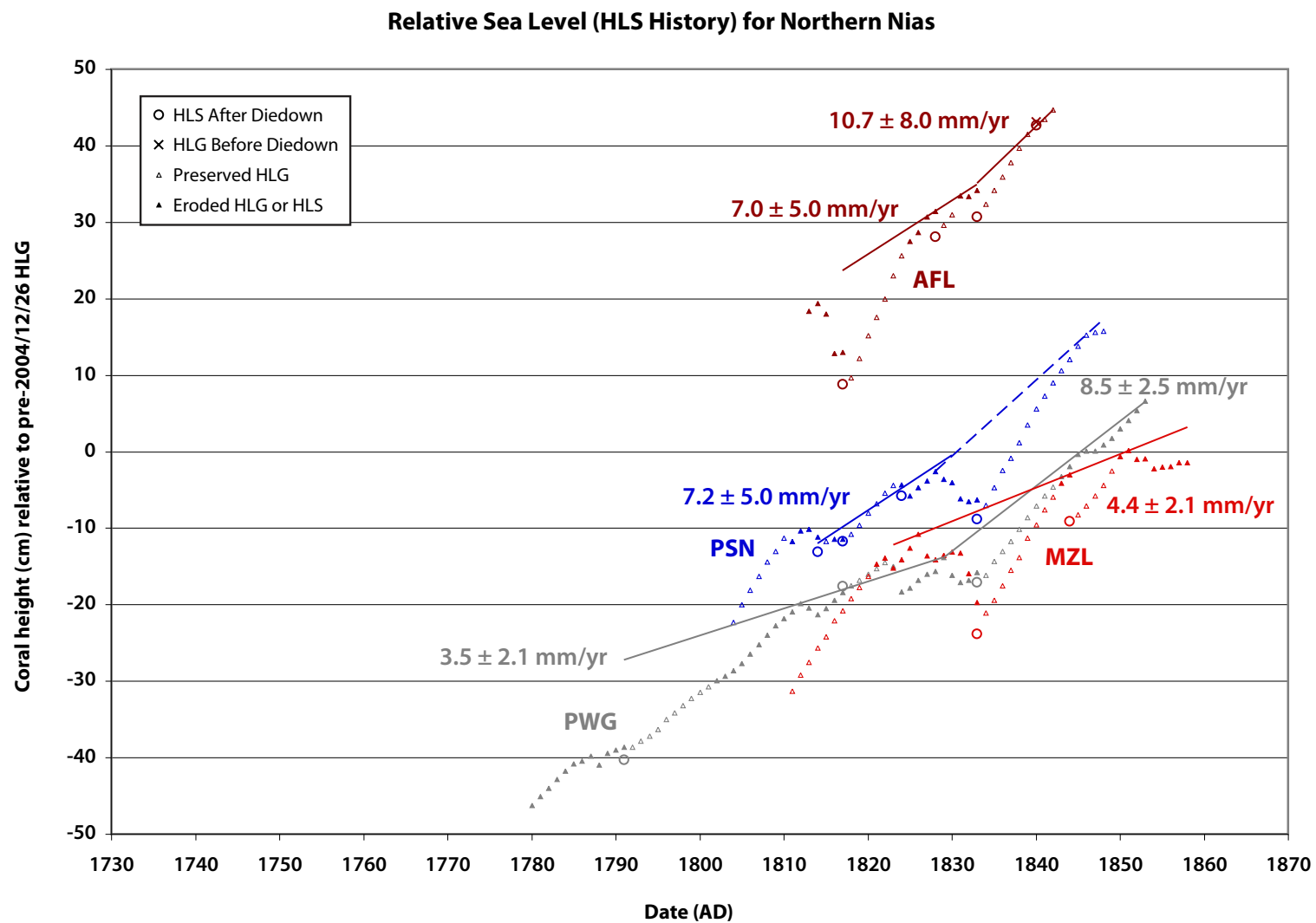


Figure S83. Relative sea level history for the 18th–19th centuries for Northern Nias. Different colors represent data from different sites.

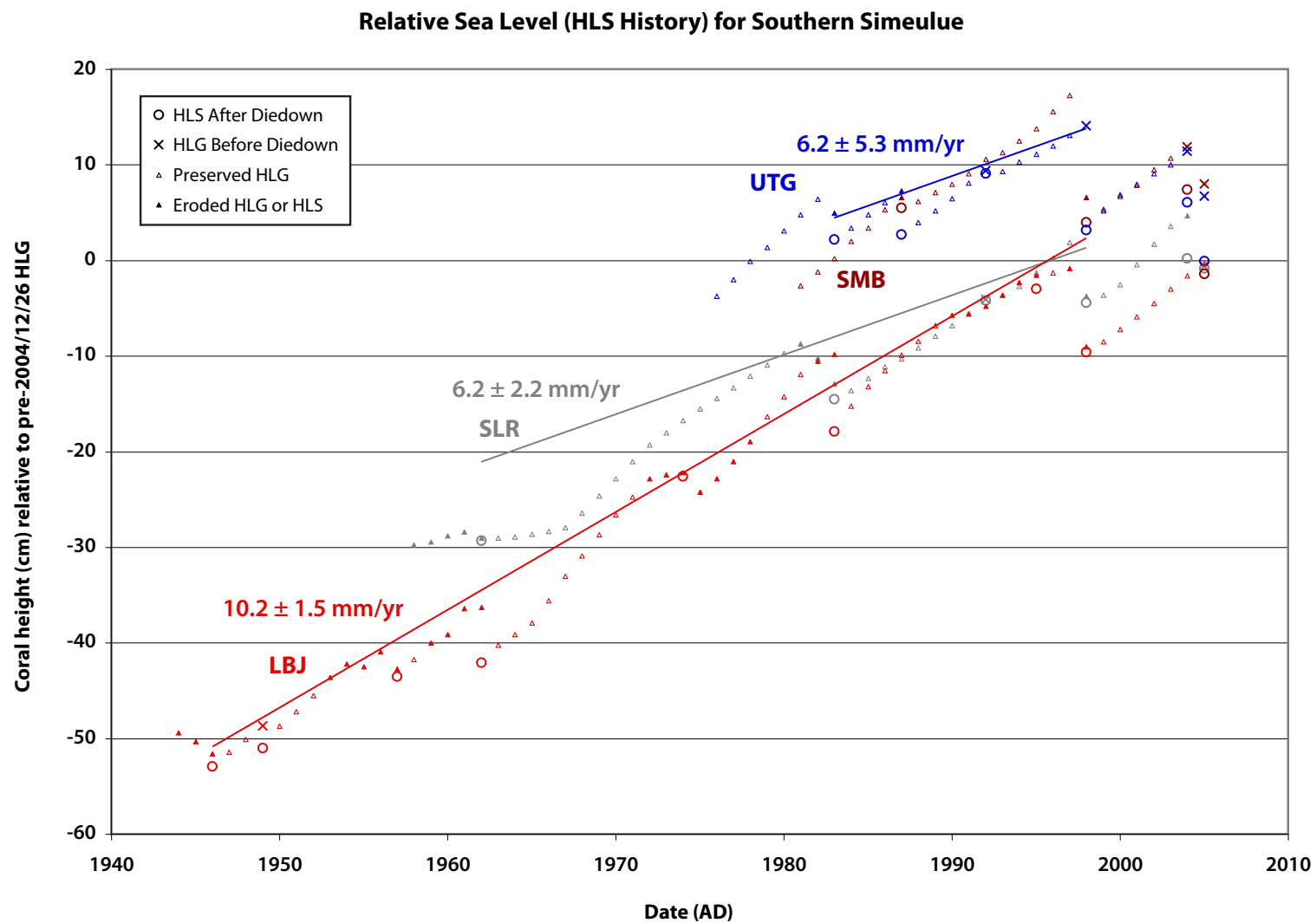


Figure S84. Relative sea level history for the 20th century for Southern Simeulue. Different colors represent data from different sites.

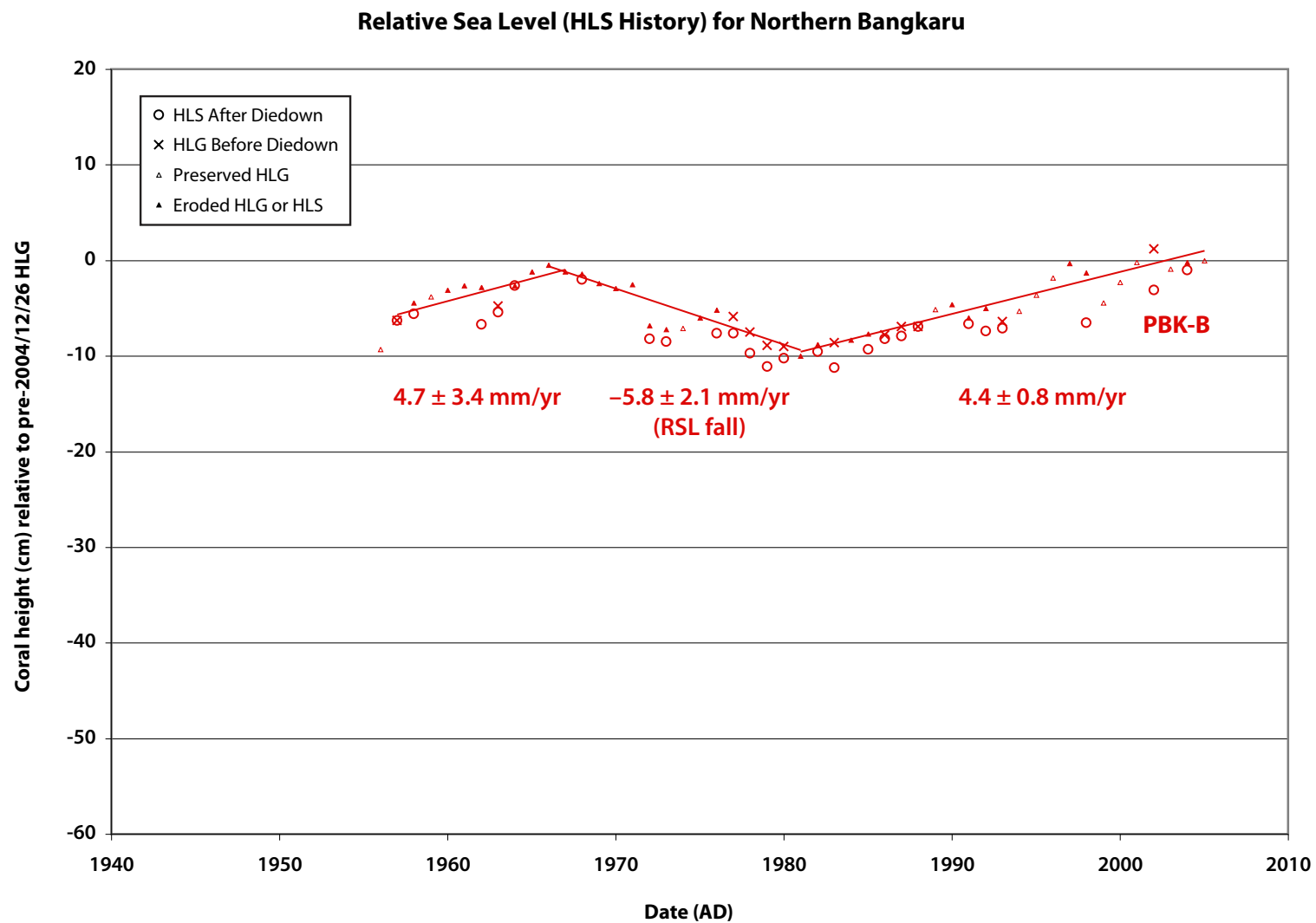


Figure S85. Relative sea level history for the 20th century for Northern Bangkaru.

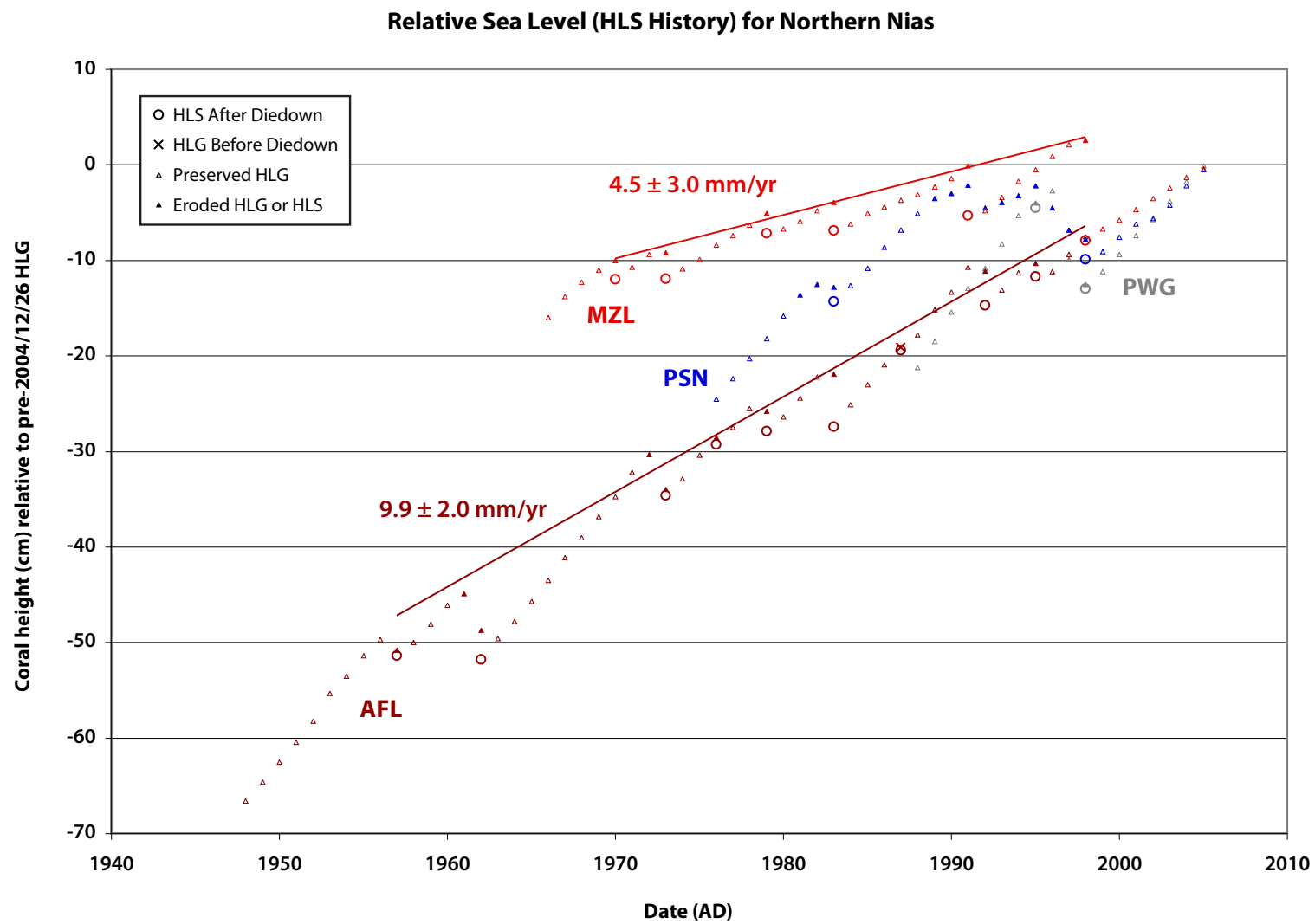


Figure S86. Relative sea level history for the 20th century for Northern Nias. Different colors represent data from different sites.

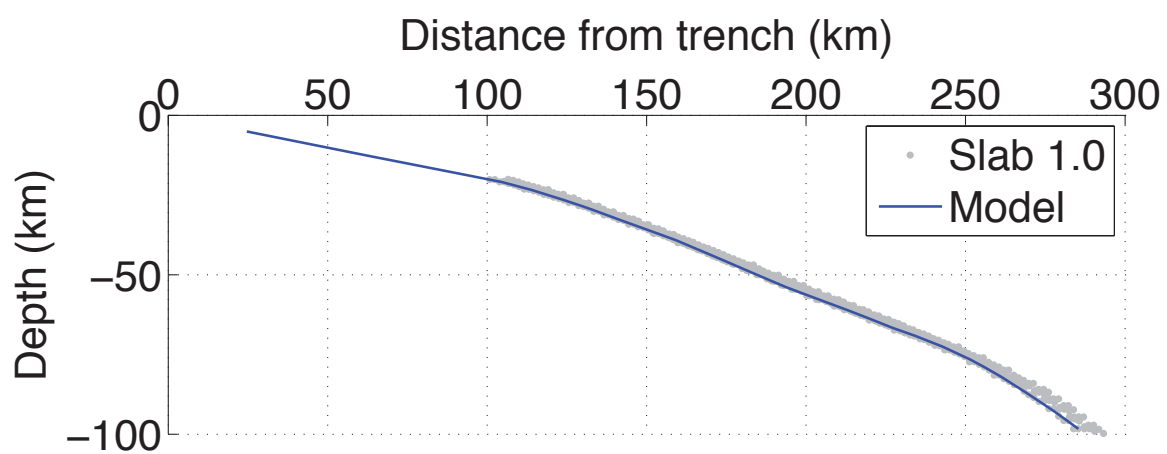


Figure S87. Comparison of our variably dipping fault geometry (the “model”) with the geometry of Slab 1.0 [Hayes et al., 2012] for the Simeulue–Banyak Islands section of the megathrust (several profiles of Slab 1.0 are overlain). Depths are relative to sea level.

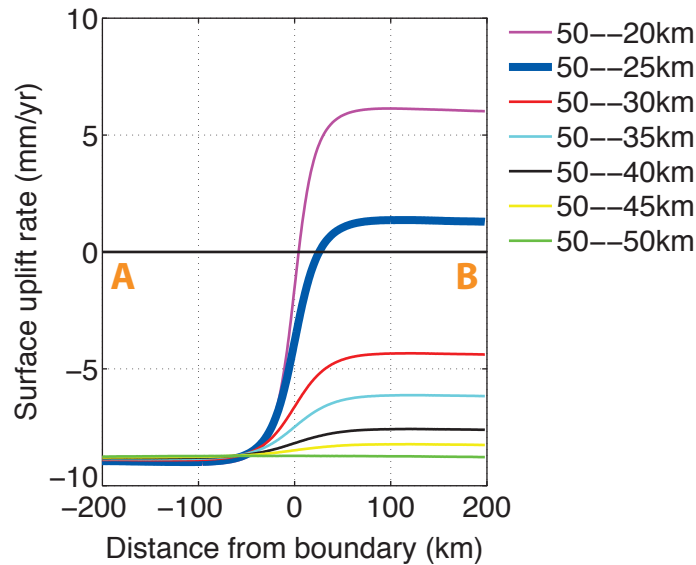
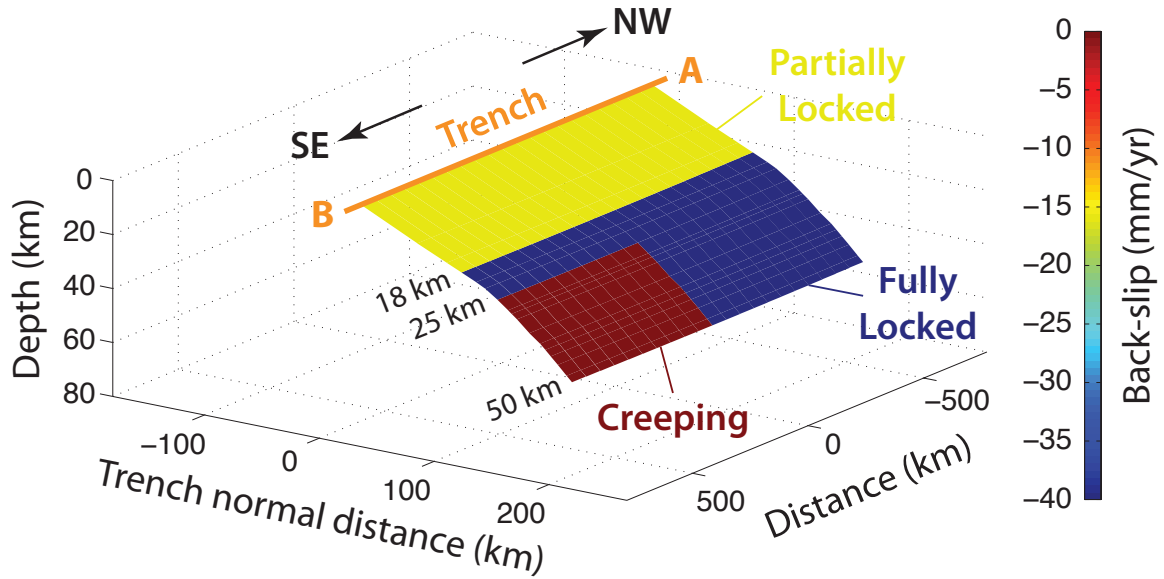


Figure S88. (Top) An example elastic dislocation model setup for testing the effects of along-strike variations in the locking depth under Simeulue. This example illustrates a model with a change in the downdip limit of locking from 50 km depth in the northwest (A) to 25 km in the southeast (B). The shallowest part of the fault, above 18 km depth, is partially locked with a coupling ratio of 0.4. Below 50 km (not shown) the fault is creeping uniformly at the subduction rate (zero back-slip). (Bottom) Curves showing along-strike variations in the interseismic subsidence rates predicted along a hypothetical row of surface points located 110 km from the model trench. This is plotted in a manner similar to Figures 17–18. The thick blue curve corresponds to the model shown at the top of the figure. (In Figures 17–18, the thick curve corresponds to our preferred model in each case.) The thinner lines are a subset of the other models considered, shown only to help illustrate how the subsidence would be affected by a different locking depth. Note that deeper locking corresponds to faster subsidence, but there is a transition zone of finite width between regions of different locking.